# Railway Age

## DAILY EDITION

FIRST HALF OF 1920—No. 11b CHICAGO—WEDNESDAY, MARCH 17, 1920—NEW YORK SIXTY-FIFTH YEAR

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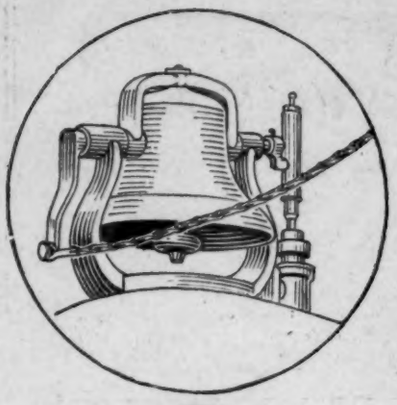

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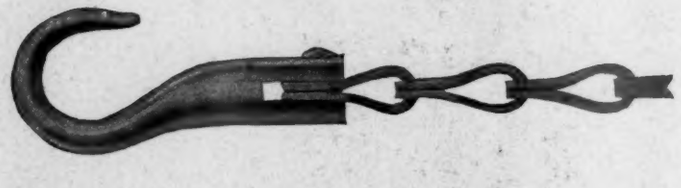

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# EDITORIAL

Railway Age

## DAILY EDITION

**Continue Work of Sectional Committees**

The work being accomplished by the sectional committees of the Signal division is of benefit to the entire signal fraternity. Through such meetings the Signal division has an exceptional opportunity for obtaining first-hand information of conditions affecting the operation and maintenance of signal systems, since the men attending such meetings are those who are in direct contact with and have to solve the everyday problems. Not only are these meetings of benefit to the division as a whole, but they are of a distinctly educational character to the men fortunate enough to attend them. Increased efficiency is being promoted by the meetings and the railroad officers throughout the country can well afford to encourage such gatherings. As was indicated at the Monday session of the Signal division, the future status of the division is uncertain, but this should in no way tend to discourage sectional committee meetings, which should be carried on as they have been in the past year.

**Busy Year Ahead of M. of W. Departments**

On March 1 the roads were returned to their owners, and it is now possible to plan for the future with some degree of assurance that such plans as may be approved will be carried to a conclusion. Generally speaking, however, improvement programs of any magnitude are planned years in advance. The railroads, owing to the period of uncertainty through which they have just passed and for other reasons, such as high cost of materials and labor and difficulties encountered in securing them, have not in the main planned to carry out ambitious improvement programs this year. While there is no dodging the fact that the roads are sadly in need of additional facilities to handle the business offered, there are crumbs of satisfaction in this situation. It will permit of the concentration of efforts on restoring existing facilities to a more adequate basis. Probably this is the most important work which could be attempted at this time under any circumstances, and it may be confidently expected that maintenance of way engineers will make the most of the situation. In other words, 1920 promises to be an extremely busy year for the men of the maintenance departments.

**An Advance in the Right Direction**

One of the most noticeable of the recent developments in the railway appliance field is the introduction of higher grade and more expensive types of devices and equipment. This is indicative of the progress that may be expected during the next two or three years. These improvements, however, should not be attributed entirely to recent advances in engineering design or to improvements in manufacturing facilities, for a large part of them are not in themselves new; in fact, many of them are relatively old in other industries and are new only when considered from the point of view of the railways. This tendency is primarily a result of the recognition by the railways of the need for equipment and for accessories that will effect improvements, which are on a higher plane than have been used heretofore. Apparently this would indicate that the railways are entering the markets this year with progressive and advanced ideas as to their needs and with a thorough realization of the savings that may be made through the adoption and use of high-grade, up-to-the-minute equipment.

**Wire Line Crossings**

The crossing of wire lines over tracks may not seem to be of much importance when compared to other matters requiring the consideration of the Signal division. It is, however, of enough importance to the division to require careful consideration and action. Committee No. XVII—Pole Lines—submitted an oral report asking that the division support the stand taken by the Telegraph and Telephone division against the contemplated action of the Bureau of Standards in lowering the specification in the proposed revised rules and regulations of the National Electric Code. The Telephone and Telegraph division feels that in some instances the revised code, in so far as signal line wire crossings are concerned, does not meet exactly with its views; particularly in the case of such wires crossing over spur tracks, as under the revised code grade E construction is recommended for wires crossing over spurs not exceeding two tracks in the same span. Grade E construction is equivalent to two-thirds the strength of the grade D construction, which is required for wire lines crossing main line tracks. The revised code also states that signal lines crossing branch tracks, on which no regular schedule of operation is maintained, shall conform to grade E construction. However, there are many branch lines that are considered just as important as main line tracks. Such tracks in reality should receive thorough consideration on the part of those who must pass on the type of construction to be adopted. The hazard to life is the most important factor involved. A large number of deaths and injuries occur to railroad employees on the so-called minor tracks, and it is, therefore, advisable that extra care should be taken to avoid scant lateral and vertical clearances between such crossings and standard freight cars and to provide ample strength in the conductors, their attachments and supports at crossings over such tracks. The term "signal line" crossings should not be confused with railway signal department lines, but it refers to that general class of wire lines operating below a certain stated voltage, used mainly for some form of communication. It was the feeling of the Signal division that more information should be obtained than was presented briefly by the committee, and that careful consideration should be given to the subject before taking action. Under the circumstances the Signal division took proper action, but it is to be regretted that the members present were not given the opportunity to learn more in detail of the proposed code of the Bureau

of Standards from some of the members present who are also superintendents of telegraph, as this is a subject which must be considered in connection with signal pole line construction work.

## Units of Measure

THE MEASURE OF MAINTENANCE of way labor is a subject which for several years has been under consideration by the association. During the last year of government control the director general drew attention to the universal need for some unit or units of maintenance comparable with units for transportation. More recently the American Railway Association made a request on Section II, Engineering, for a report on "measures toward obtaining higher efficiency and economy in the maintenance of way and structures department, and a plan presented to the executive committee which will effect the greatest economy and efficiency in the maintenance of way and structures department, both as to handling of labor and material; and, further, that suggestions be made as to the units by which the maintenance of way and structures work may be gaged, the recommendations to include suggestions as to improvements in supervisory methods and especially in the direction of educating the supervisory forces to the importance of the subject."

The study of units of measure in general will early convince the investigator that they by no means always measure. The train-miles, freight and passenger, have been objects of our tender solicitude in a business and professional way for many years. They have served us through weary hours of office compilations on which were based reports whose number is legion and which are now neatly folded and in process of crinkling with the dust of ages in pigeonholes of cabinets in offices of railway managers, presidents, chairmen of boards of directors and public commissions galore. The ton-mile has gone the traffic route to much the same destinations, and is greatly reverenced. Yet all these old acquaintances have at times been haled into court and been irreverently examined and cross-examined and pulled about and stretched on the rack of inquiry or pinched in the inquisition chancery Jarndyces until skeptical judges with cool judgment, and company lawyers with cool footing on thin ice, were forced by a scornful opposition to mental reservations as to whether these units of measure really measured minutely, or approximately, or, indeed, at all; whether they might, mayhap, be not quite rigid, whether they were not at times quite elastic, or were even non-elastic or even flaccid in certain pitiless atmospheres.

But what would you? These heavy ton-miles and weary train-miles have to traverse steep grades and wheel-grinding curves and sojourn on sidings and herd amongst their kind in congested yards. They suffer delays on account of shortages of coal and water and ships and shippers and what not, until they are as dissimilar as our very dollars that look alike yet are so variable that they will not serve as a basis of quotation for a salesman ten hours away from headquarters! Still we strive to exist in a dollar world, a shrinking world, a 50-cent United States, a 40-cent Europe, a 25-cent Mexico, and utterly worthless Russia. And yet man needs dollars and ton-miles and ouija boards—and moreover units of maintenance as means to measure and forecast the serious things of life, the necessities, the extravagances, the expectations, and now the work!

As the cost of hauling one ton of freight one mile is a unit of transportation, so the natural measure of maintenance would seem to be the cost of the work of one man in one hour. There is no doubt nor difficulty about it whatever—we have merely to say what work and what man and what hour, and the thing is done. For there are many kinds of work, as company work and union work and Sunday work, just as there are divers kinds of men, and school boys, and whole families who labor in times of emergency at track maintenance, at different—oh, widely different hours—many of them time and a half or even double time hours, to say nothing of those composed of killed minutes that cannot be recorded in earthly time books.

But the average man in an average hour at an average rate performs an average service. No, this is not necessarily an organized unit; it is a perfectly sound, even a chesty theory. The average of work thus done by a laborer in one hour is then a fair measure of maintenance. The whole trouble lies and always has lain at the door of the civil engineer. He is a creature of fact. He has no imagination, no horizon of the fourth dimension, as it were. He cannot let well enough alone, but must needs query and poke about and utterly discredit quite well-built theories and units and other like fancies. He objects that no two men are alike, that they do not move in unison, nor adopt the same methods of using tools, or handling dirt, or tamping ties; their foremen have ideas and give dissimilar instructions unless the supervisors who have still different methods insist on every one doing their way, or the roadmasters get new implements to be used or the engineer or the general manager, or the president or the chairman of the board—but why continue when it is all so evident that units of measure of maintenance must first be established by virtue of the highest authorities in the railway world regulating the way of doing the work just as the government established the way of minting a dollar before it could be coined and actually made a measure of value.

What is needed first of all in maintenance of way is organization from the tip top among all railways to insure that all lines adopt standard ways of performing labor. It may then be possible to gather data on which to base statistics showing what one laborer in one hour should accomplish at each kind of work assigned him. Until this authority is available we will carry on in the good old way, or ways, doing our best with what we have and without that which we have not.

## The Wearing of the Green

WEDNESDAY, THE 17TH, THE BIG day of the A. R. E. A. convention, assumes added importance as St. Patrick's Day, the holiday most dear to those who love the "ould sod" and the Irish. The very name of it thrills the blood of the real men of all climes, and particularly the American railway officer. We, of all men, have reason to love the Irish who long ago proved their worth as real railroaders when the thousands of miles of transcontinental tracks were laid which traverse the country from the Atlantic to the Pacific. This construction was done largely by the thousands of Irish workmen who were landed at Eastern ports—all they loved behind them in Erin, and the future before them a sealed book into which they looked with fearless blue eyes and with undaunted spirits. "From Kilkenny to Cork and from Cork to New York" was only half a trip to Pat, who, stopping only long enough to find his bearings and take the bundle from his shoulder, shipped overland and "westward ho!" to the end of the track. He had never a care for the future, but was filled with the warm-hearted, whole-souled, devil-may-care freedom of spirit which marks the Son of Erin, who is at soul an adventurer, with the rugged physique, the red blood and the clear eye that bespeak the love of conquest, the spirit of the conqueror, and the restlessness of push and of progress that have made of the American

railroad the pathway to a great civilization and the United States a world power.

Of all the men of all the nations of earth who have landed on our shores there were and are none to touch Pat as a trackman. Our memories go back to the days when the steam shovel was not, when the Irish made railroading a joy, when the eight-man iron gang tossed rails from leather-aproned loins with unprotected hands, when the "boss" was king, when spikers were spikers, when a meal was as free as a fight to any and all who dared the slogan "Come out and scrap the Dutch." Gone are the days, gone are the "byes." But sweet are the memories of deed and of word, of duty done with brain and brawn, of their zest in the work we depended on—and still in revery we watch them toil, these brawny giants, and we hear their lusty chorus: "Saturday morning at 7 o'clock, 13 terriers stood on a rock. Drill, ye terriers, drill."

Oh, for a million such trackmen, oh, for a hundred such section foremen, or even just one! All honor to Pat and his memory. Three cheers for the Irish, the greatest trackmen of them all.

## Today's Program

The program for today, Wednesday, March 17, is as follows:

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|---|---|
| Economics of Railway Location | Bulletin 221 |
| Wood Preservation | Bulletin 222 |
| Ballast | Bulletin 222 |
| Iron and Steel Structures | Bulletin 223 |
| Stresses on Railroad Track | Bulletin 224 |
| Ties | Bulletin 223 |
| Roadway | Bulletin 224 |
| Rules and Organization | Bulletin 222 |
| Economics of Railway Labor | Bulletin 223 |

## Construction Work on A. B. & A.

Signal construction work has been authorized on the Atlanta, Birmingham & Atlantic, covering the installation or changes in a number of interlocking plants and the installation of automatic block signals over certain sections of the line. Work on this program will be started about June 1.

## Anyway, They Tried Hard

The executive committee of the Railroad section, Western Society of Engineers, played in hard luck in its efforts to provide a program for a meeting during the course of this week's conventions. As a consequence, those who went to the society's rooms last night were turned away with the notice that the speaker of the evening could not appear.

This was the culminating disappointment in Chairman C. F. W. Felt's endeavors to arrange a meeting. Several weeks ago Mr. Felt invited G. A. Tomlinson, until recently director of inland waterways, United States Railroad Administration, to talk on the present status of the inland waterways, but Mr. Tomlinson was unable to come, and after trying unsuccessfully to get someone else from Washington, Theodore Brent of St. Louis, formerly assistant chief of the division, agreed to talk. Announcements to this effect were printed and Mr. Brent was in Chicago Monday, but was called out of town. After another canvass, Prof. Harold G. Moulton of the University of Chicago was prevailed upon to fill the gap, but was unable to appear on account of illness at the last minute.

## Mr. Hooley on Coming of Age

"DID YE SAY THIM INJINEERS was only twinty-wan years owld?" inquired Mr. Dennissey, as he strolled into Mr. Hooley's place a full hour earlier than his usual time, on account of his interest in the subject of their conversation of the evening before. "I saw siveral av thim at th' Congriss Hotel th' day that was, 'nd iv they're only twinty-wan, 'tis a hard life they've been leadin', I'm thinkin'."

"'Tis a har-rd life they've been leadin' arl right," replied Mr. Hooley. "But, Dinnissey, 's I've so often towld ye, iv ye got annything straight th' first time, 't wud lead ye'er neighbors to some suspicion as to the sobriety av ye'er habits. 'T was th' Association I was a-shpakin' av, 'nd not th' injineers individooally or by name."

"I mind now," continued Mr. Hooley, reminiscently, "'t was in 1898, th' year we begun to forget to remimber th' Maine 'nd what Admirable Jewey'd done at Manilla—'t was spilled wit' two l's, Dinnissey, til Jewey knocked wan av thim out—'t was that year a handful av min mit at th' Aujitorium 'nd laid th' foundations av th' great 'nd inflooential Association that's been holdin' convintions in Shecawgo ivery year since. 'Twas only th' nixt year th' christenin' tuk place at Buffalo, but that is ancient history, f'r t' connect ye up wit' what I'm goin' t' tell ye.

"Twinty-wan years 'nd goin' sthrong," reminisced Mr. Hooley, "till inst'd av givin' thim their time 'nd a freedom suit th' crool uncle they'd been livin' wit' th' lasht few years turned thim loose on a cowld wor-rld wit' nothin' but th' owld clothes they had on whin they came t' live wit' him 'nd wit' some extra wear, forby they'd had har-rd wor-rk to do f'r five years on account av th' great war-r.

"'Tis in th' way av a parrabul I'm shpeakin', Dinnissey," continued Mr. Hooley. "Th' injineers thimselves is arl right, but their wor-rkin' tools 'nd their clothes 'nd th' property they're to work on is badly run down. 'Tis th' work av th' injineers t' kape up th' thracks, 'nd th' buildin's, 'nd th' wather stations. But I've another shtory t' till ye tomorrer 'nd that's why I'm tillin' ye so much about th' Association bein' twinty-wan years owld. Ye wudn't think they'd hav anny use f'r a wit noorse, wud ye, Dinnissey?"

"I wud not," replied Dennissey.

"They don't," asserted Mr. Hooley, "but since th' crool uncle lit thim go their own way th' female rilitives av th' family wud like t' continue gettin' th' benefits av their wor-rk 'nd don't seem willin' t' give them th' credit f'r havin' grown up."

## Electrical Testing Committee to Meet

A meeting of Committee 13, electrical testing, of the Signal division of the American Railroad Association, will be held in the English Room of the Congress Hotel at 9 a. m. today.

## Annual Dinner Tonight

The annual dinner of the American Railway Engineering Association will be held in the Gold room of the Congress hotel at 6:30 this evening. The speakers include the Hon. and Rev. Henry J. Cody, M.A., D.D., LL.D., former minister of education, Ontario Government, and Winthrop E. Stone, Esq., president, Purdue University, La Fayette, Ind. Tickets for the dinner are on sale in the lobby outside the Florentine room, W. A. Wallace of the Arrangements committee in charge.

*A. R. E. A. in Session Tuesday Afternoon*

# Railway Engineering Association Proceedings

## Report of Tuesday's Sessions, Including President's Address and Abstracts of Several Committee Reports and Discussion

SHORTLY BEFORE 10 O'CLOCK yesterday morning the Florentine Room of the Congress Hotel again witnessed the opening of the convention of the American Railway Engineering Association, this being the twenty-first annual meeting. President Earl Stimson, general superintendent of maintenance of way and structures of the Baltimore & Ohio, was in the chair. The attendance at this session was fully as large as for the first session last year, thereby promising a very successful convention. As the minutes of last year's meeting had been printed and distributed, their reading was dispensed with and the convention passed immediately to the president's address. Following this the reports of the secretary and treasurer were presented, after which the association began the consideration of the reports of committees.

## Address of President Stimson

DURING THE YEARS 1917 AND 1918 this association shared with all other enterprises the handicaps imposed by our country's participation in the great war. The past year has seen the return to more normal conditions, releasing us from the exacting war time duties and allowing more time and thought to be given the work of this association. Our finances, as shown by the statement for the year ending December 31, 1919, are in a healthy condition.

For a time the membership situation gave us some concern, as applications for new membership were coming in slowly. There were appreciable losses, through resignations, death and other causes. It appeared that the net gain for the year would be small. At a meeting of the Board of Direction in November it was decided to increase the membership and a committee, with Mr. Downes as chairman, was appointed to conduct a membership campaign. This was undertaken in a systematic manner—each railroad being called upon to produce a given number of new members and a member from that road was appointed chief producer. In proof of the success of the efforts of Mr. Downes and his committee since January 27, 1920, when this campaign was launched, 180 new members have been added, making a total of 270 since the last convention, a net gain of 190. Our total membership now is 1,639.

Since our last meeting I regret to report that we have lost 11 of our members by death. Four of this number were charter members of the association, namely:

Curtis Dougherty, chief engineer of the Western lines of the Southern Railway. He was very active in the association's affairs. He was a member of the committee appointed at the preliminary organization meeting to propose a name for the association. He took part in committee work as chairman of a committee and a member of other committees. He also served as a director.

William Archer, at one time division engineer and principal assistant engineer of the Baltimore & Ohio, was an active member of a committee in the days when the association was young.

J. A. Atwood, chief engineer, Pittsburgh & Lake Erie, and second vice-president of the association. Mr. Atwood was from its organization one of the live members of the association, serving as chairman of the rail committee and of the yards and terminal committee. He was a member of the Board of Direction and at the time of his death was second vice-president. We will ever remember Mr. Atwood for his sterling worth as a gentleman and as an engineer. We will miss him from this meeting.

C. N. Kalk, chief engineer, Soo Line, also a charter member and an active worker on a committee.

Other members who have been taken from us are A. J. Himes, valuation engineer, New York, Chicago & St. Louis; E. Raymond, general superintendent, Santa Fe; S. P. Brown; H. T. Ruhl, engineer maintenance of way, Delaware & Hudson; J. D. Mason, Great Northern; W. A. Casker, formerly with the Chicago & Western Indi-

ana, and N. Tani, Imperial Government Railways of Japan.

Five years have passed since the last issue of the Manual. It has been decided that the number of additions and changes to the 1915 issue justify a republication this year. The volume of matter presented in the form of committee reports exceeds that of any previous year. In quality it is fully up to the high standard of the association and reflects great credit on the chairmen and members of their committees.

It has been the policy of this association to co-operate with other associations in the advancement of the common interests. In this manner the resources of the several associations are combined and produce the best results as well as tend towards uniformity and standardization. During the past year this policy of co-operation has expanded to the extent that the association has through its committees acted as the construction and maintenance division of the engineering section of the American Railroad Association. This action was forecast by President Morse in his address at the opening of the convention last year. The general plan then outlined has been carried on in detail as follows:

Under the reorganization of the American Railroad Association by the United States Railroad Administration, an engineering section was included. In order to avoid a duplication of work and to utilize the efficient working organization of the American Railway Engineering Association, some arrangement to that end was sought. At first it was proposed that the organization of this association be taken over by the American Railroad Association to become a part of its engineering section. This proposition was voted down by this association by a large majority. The offer of this association to act as a division of the engineering section was finally accepted. The engineering section is presided over by a general committee of 11 members, 6 from the construction and maintenance division, 3 from the signal division and 2 from the electrical division. This gives this association a majority membership on the general committee. The president of this association is chairman of the general committee and of the section, and the secretary acts for both of these organizations.

**Earl Stimson**
**President, American Railway Engineering Association**

By action of the general committee the members of the standing and special committees of the American Railway Engineering Association were appointed members of like committees of the engineering section of the American Railroad Association and the outline of work assigned to the committees by the Board of Direction of the American Railway Engineering Association was approved and accepted by the general committee of the engineering section of the American Railroad Association. The committee members thus virtually became members of both associations and the one set of committees carried on the same work for both. From time to time requests for special reports have been made by the American Railroad Association through the general committee, which the committee has through the secretary assigned to the proper committee for handling. Several important requests of this nature have been handled, notably, "The Specifications for Railroad Track Scales," "Rules for the Prevention of the Spread of Forest and Field Fires," "A Special Report by the Tie Committee on Metal Versus Wooden Ties," and the subject now under consideration, "Measures to Obtain Higher Efficiency and Economy" in the maintenance of way and structure department, both as to the handling of labor and material; and to make suggestions as to the units by which the maintenance of way and structure work may be gaged.

At the annual meeting of the American Railroad Association last November, the engineering section included in its report for approval such subjects as were adopted as recommended practices by this association at the convention a year ago. These were approved at that meeting and now bear the endorsement of the American Railroad Association. What better way is there for the recommended practices of this association to come into general use on the railroads of this country than to bear such endorsement?

The American Railway Engineering Association during the past year has been performing the functions of the construction and maintenance division of the American Railroad Association, the contact between the two being maintained through the general committee of the engineering section, the majority of whose members are officers and members of this association.

This relationship has in other ways also been of advantage. The consolidation of the offices of the two associations and the secretary and his office force acting for both, have divided the expense, and in addition the American Railroad Association has been generous in financing committee work of a special character. The sum of $9,000 per year for two years was provided for the continuance of the work of the committee on "Stresses in Railroad Track" and $7,500 was given for the Rail committee to carry on its work for the year. The expense was paid of the inspection trip of the Committee on Electricity over the electrified division of the Chicago, Milwaukee & St. Paul and also of the trip of a sub-committee of the Yards and Terminals committee for the purpose of studying the unit operation of terminals.

There were some among us who viewed with alarm this arrangement, and stood by terrified, evidently expecting to see the lamb devoured by the lion. But how groundless their fears! They must now realize, as they sit here in this convention, that the American Railway Engineering Association is as strong and as independent as ever.

The problems immediately ahead of us are those of maintenance rather than those of construction. I quote from that god-father of many young engineers, the revered Wellington, who in defining engineering says, "It is the art of doing that well with one dollar, which any bungler can do with two after a fashion." The definition applies quite as aptly to maintenance engineering as to construction engineering.

The item of labor is greater than all the other items of maintenance expense combined. What a chance there is here for the practice of engineering—the engineering of men. How much more can be done with one dollar's worth of well-directed effort than with two dollars' worth of bungling.

It is now the duty of the engineer to seek to make the work attractive to the worker by attention to his living and working conditions. Pay him an adequate wage. Put the man under a foreman who knows proper methods and who can direct him in the use of those methods. Furnish a standard of performance as a measure of his creative power which will stimulate his interest towards increasing that creative power. Respect his rights, treat him fair. Then watch the one dollar do the work of two.

The increased costs of both labor and material have so swelled the expense of maintenance that more accurate cost accounting and unit measures of performance are needed. It is sought to reduce maintenance costs to a single unit of measure so that a uniform gage of maintenance may be had. It is difficult to correct unless we know wherein we are wrong. Our committee on Economics of Labor is now working on this problem.

The shunning of railroad service by the young engineer is a matter of concern. I noticed a short time ago in a technical publication a series of letters written by the professors of engineering of a number of universities, on why the graduate engineer is not entering railroad service. The chief reason given was that they found more attractive service elsewhere—the more attractive features being better pay, less exacting working conditions and better prospects of advancement. I cannot believe this to be a permanent or even a general condition. The young engineer graduate has only to look at the long list of prominent railroad officers who started on the engineering corps and attained to positions comparable in compensation with the high positions in the industries.

This association is dependent upon the young railroad engineer for its perpetuation. It is therefore the mission of the members of this association to present to the young engineer the advantages and possibilities of railroad service, and when they have entered that service to help them in every possible way toward the realization of those possibilities.

### Report of the Secretary and Treasurer

The twenty-first annual convention of the association marks another onward and upward step in its continued progress. Financially, in the growth of membership, and in enhanced prestige the results obtained in the year just closed have been most gratifying.

By reference to the financial statement it will be noted that the receipts from all sources were $31,187.24; the expenditures, $24,702.03, leaving a surplus for the year of $6,485.21.

The volume of committee reports submitted for consideration at this convention exceeds that of any former year. The additions made to the Manual since its last publication have warranted the Board of Direction in deciding on reprinting the volume during the current year.

As pointed out in the address of the president, a systematic effort has recently been inaugurated to increase the membership. The results thus far secured have been exceedingly gratifying and encourage the hope that even greater gains will be obtained during the coming year.

| | | |
|---|---|---|
| Membership at the last annual meeting | | 1,449 |
| Admitted during the year | 270 | |
| Deceased during year | 12 | |
| Resignations | 39 | |
| Dropped | 30 | |
| | 81 | |
| Net gain | 189 | 189 |
| Total membership | | 1,638 |

With deep regret we record the loss by death of the following members: John A. Atwood, second vice-president of the association; Curtis Dougherty, at one time a director of the association; Albert Himes, formerly chairman of the Committee on Iron and Steel Structures; Stephen Pearson Brown, Williams Archer, N. Tani, E. Raymond, J. D. Mason, C. N. Kalk, H. T. Ruhl, W. A. Casler, F. T. Hatch.

Respectfully submitted,

E. H. Fritch, Secretary.

### Financial Statement for Calendar Year Ending December 31, 1919

| | | |
|---|---|---|
| Balance on hand January 1, 1919 | | $37,259.19 |
| **RECEIPTS** | | |
| Membership Account | | |
| Entrance fees | $ 1,470.00 | |
| Dues | 6,726.75 | |
| Subscription to Bulletin | 6,726.75 | |
| Binding Proceedings and Manual | 682.35 | |
| Badges | 31.00 | |
| Sale of Publications | | |
| Proceedings | 2,056.22 | |
| Bulletins | 866.06 | |
| Manual | 408.97 | |
| Specifications | 111.25 | |
| Leaflets | 27.00 | |
| General Index | 81.00 | |
| Advertising | | |
| Publications | 2,040.20 | |
| Interest Account | | |
| Investments | 1,783.67 | |
| Bank balance | 73.97 | |
| Annual Meeting | | |
| Sales of dinner tickets | 1,291.50 | |
| Miscellaneous | 56.02 | |
| American Railroad Association | | |
| Rail Committee | 6,753.93 | |
| Total | $31,187.24 | |
| **DISBURSEMENTS** | | |
| Salaries | $ 5,850.00 | |
| Proceedings | 1,018.00 | |
| Bulletins | 5,237.09 | |
| Manual | 4.55 | |
| Stationery and printing | 731.39 | |
| Rents and light | 868.11 | |
| Telegrams and telephone | 68.06 | |
| Equipment | 27.45 | |
| Supplies | 326.78 | |
| Expressage | 318.31 | |
| Postage | 806.65 | |
| Exchange | 53.10 | |
| Taxes | 29.25 | |
| Committee expenses | 133.50 | |
| Officers' expenses | 16.00 | |
| Annual meeting expenses | 1,977.67 | |
| Refund dues account duplicate payments, etc. | 32.00 | |
| Audit | 100.00 | |
| Miscellaneous | 245.20 | |
| Rail Committee | 6,858.92 | |
| Total | $24,702.03 | |
| Excess of receipts over disbursements | | $ 6,485.21 |
| Balance on hand December 31, 1919 | | $43,744.40 |
| Consisting of: | | |
| Bonds | $40,565.65 | |
| Cash in S. T. & S. Bank | 2,977.83 | |
| Cash in Secretary's office | 175.92 | |
| Petty cash in Secretary's office | 25.00 | |
| | $43,744.40 | |

### Stresses in Track Fund

| | | |
|---|---|---|
| Balance on hand January 1, 1919 | | $ 1,461.35 |
| Received from interest during 1919 | | 39.51 |
| | | $ 1,500.86 |
| **DISBURSEMENTS** | | |
| Salaries | $ 134.14 | |
| Transportation | 36.14 | |
| Hotel and meals | 42.90 | |
| Telephone and telegrams | 1.71 | |
| Supplies | 219.68 | |
| Postage | 30.00 | $ 464.57 |
| Balance on hand in Standard Trust and Savings Bank, December 31, 1919 | | $ 1,036.29 |

Respectfully submitted,

Board of Direction.

### Report of the Treasurer

| | | |
|---|---|---|
| Balance on hand January 1, 1919 | | $37,259.19 |
| Receipts during 1919 | $31,187.24 | |
| Paid out on audited vouchers during 1919 | 24,702.03 | |
| Excess of receipts over disbursements | | $ 6,485.21 |
| Balance on hand December 31, 1919 | | $43,744.40 |
| Consisting of: | | |
| Bonds | $40,565.65 | |
| Cash in S. T. & S. Bank | 2,977.83 | |
| Cash in Secretary's office | 175.92 | |
| Petty cash in Secretary's office | 25.00 | |
| | $43,744.40 | |

### Stresses in Track Fund

| | |
|---|---|
| Balance on hand January 1, 1919 | $ 1,461.35 |
| Received from interest during 1919 | 39.51 |
| Total | $ 1,500.86 |
| Paid out on audited vouchers during 1919 | 464.57 |
| Balance on hand December 31, 1919 | $ 1,036.29 |

The securities listed above are in a safety deposit box of the Merchants' Loan & Trust Safe Deposit Company, Chicago.

Respectfully submitted,

Geo. H. Bremner, Treasurer.

### General Balance Sheet, December 31, 1919

ASSETS

| | 1919 | 1918 |
|---|---|---|
| Due from members | $ 3,142.00 | $ 2,495.35 |
| Due from sales of publications | 542.27 | 1,823.94 |
| Due from advertising | 985.00 | 400.00 |
| Due from Amer. R. R. Assn. (Rail Committee) | 575.97 | 470.98 |
| Due from Amer. Express Co. for lost shipment | 250.00 | |
| Furniture and fixtures (cost) | 997.40 | 997.40 |
| Gold badges | 73.50 | 51.00 |
| Publications on hand (estimated) | 6,000.00 | 6,000.00 |
| Extensometers | 500.00 | 500.00 |
| Investments (cost) | 40,565.65 | 35,065.65 |
| Interest on investments (accrued) | 739.99 | 711.96 |
| Cash in Standard Trust & Savings Bank | 2,977.83 | 2,168.54 |
| Cash in Secretary's office | 175.92 | |
| Petty cash fund | 25.00 | 25.00 |
| Total | $57,550.53 | $50,709.82 |

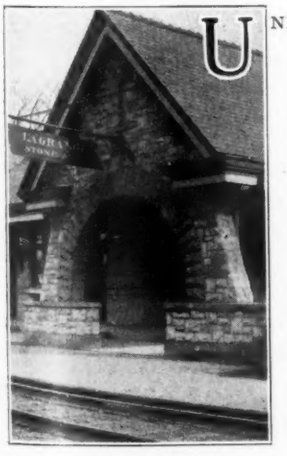
LIABILITIES

| | | |
|---|---|---|
| Members' dues paid in advance | $ 2,272.50 | $ 2,053.50 |
| Impact test fund on electrified railways | 285.46 | 285.46 |
| Advertising paid in advance | | 120.00 |
| Due for printing Proceedings | 1,845.00 | |
| Due for expressage | 183.67 | |
| Due for miscellaneous bills | 39.00 | |
| Surplus | 52,924.90 | 48,250.86 |
| Total | $57,550.53 | $50,709.82 |

### Metric System of Measures

The question of legalizing the metric system of measures in this country was brought before the Tuesday morning session of the Association and after an address by W. C. Wilson, representing the American Institute of Weights and Measures, W. H. Courtenay (L. & N.) offered the following resolution, which was adopted: The American Railway Engineering Association, in convention assembled, expresses its opposition to the adoption of the metric system of weights and measures to the exclusion of the English system or the American system at present in general use.

# Report of Committee on Buildings



Under the head of revision of the Manual, the committee offered some revised definitions and also submitted the following:

On page 18, in the supplement to the Manual, it was proposed to change the recommendation for high platforms at passenger stations to read as follows: "It is recommended that high platforms be provided only in connection with tracks devoted exclusively to passenger business on account of clearances."

On page 218 there is a subject in the Manual entitled, "Sanitary Provisions for Medium Sized Stations." The committee recommended that the first three paragraphs referring to water closets and chemical toilets be eliminated and that the last paragraph only be reprinted in the Manual. The committee also recommended that the two words "Medium Sized" be left out, as the recommendations would apply to all stations.

### Subject (2). Coaling Stations

The committee recommended the publishing as a matter of information in the proceedings, an article on fuel conservation prepared by the United States Railroad Administration, as covered by its Circular No. 17, dated Washington, April 20, 1918.

### Ash Pits

The committee recommended publishing an illustration of a steam conveyor ash pit as a type, without recommendation as to its preference. A number of railroads have provided protection for the water type of ash pits, consisting of wood floats, floats made out of boiler tubes on angle iron frame, but the result from the use of these has been questionable, as the operator does not always replace the protection in proper manner and it is easily broken. In the tube type of float the sulphuric acid in the water soon causes deterioration. The committee, therefore, recommended that on deep water ash pits a walkaway be provided on the water side of the running track, so that hostlers can work on the engine on this side without danger of falling into the pit.

In addition to this protection, ¾-in. rods spaced 1 inch apart have been installed in the running track. Some roads place these rods in a frame approximately 10 ft. long, placing them between the rails so that they can be removed when necessary. It is considered preferable to fasten the rods so that they cannot be removed.

### Subject (7). Efficient and Economical Methods of Electric Lighting for Passenger Station

Lighting in and around passenger stations is provided in order to add to the safety and convenience of the public and employees, and adequate lighting is well recognized as one of the most effective police measures against crimes and invaluable as a sanitary precaution, but any illumination that does not directly contribute to security and convenience should be avoided.

### Passenger Station Interiors

There are three types of electric lighting which can be used for passenger station illumination: Direct, semi-direct and enclosed units and indirect.

Direct lighting is the most commonly used for station illumination and is recommended as the installation for stations where economy in first cost, operation and effi-

ciency of lighting is desirable. Semi-indirect lighting is used frequently, but is more expensive as to first cost and is about 60 per cent as efficient as direct lighting on a new installation, decreasing in efficiency on account of dust covering the reflecting surfaces. The totally enclosed type of fixture is the better of the two, as approximately the same results can be obtained and the maintenance cost is a trifle lower in so far as cleaning is concerned. Indirect lighting is not recommended for station lighting because of the expense of installation and maintenance, also for the low efficiency due to the light being absorbed by the ceiling or reflecting surfaces.

In waiting rooms the installation of the approximate average of one watt per sq. ft. of floor area will give good illumination, but there are many details to be considered, such as the difference in ceiling heights, color of wall and style of architecture. For ticket offices a minimum of 3.5 foot candles is recommended, for toilet rooms about 2 foot candles and for baggage rooms from 1 to 2 foot candles. Average conditions warrant an installation ranging from 0.5 to 1 watt per square foot.

### Passenger Station Surroundings

Driveways and walks leading to and from passenger stations can be lighted most economically by using high efficiency gas filled lamps, inclosed in frosted bowls or some other suitable fixture and spaced along the driveway and walks on posts at sufficient distance to give illumination intensity of 1. to 1.5 foot candles. Platform lighting should be so arranged that the lamps are not visible to enginemen on approaching trains. A minimum illumination intensity of 0.03 foot candles is desired for uncovered platforms. This value may be increased where conditions demand higher illumination. Shallow bowl porcelain enameled steel reflectors are recommended, the spacing of the units to be determined by the condition existing at the particular platform. Flood lighting of platforms is not recommended except in a few instances where an economical installation is absolutely necessary.

Lights for platforms with coversheds are necessarily limited to direct lights hung from the roof of the shed.

The most satisfactory arrangement of lighting units in subways is to place them on the ceiling along the center of subway, spacing them at intervals large enough to give an illumination intensity of about one foot candle.

Subway stair lights should preferably be placed in recesses on the side walls, the fixtures to be placed approximately six inches above the level of the treads, so arranged that the light will not shine in the eyes of pedestrians going up the stair. Approximately 0.5 foot candles would be sufficient to illuminate a stair.

The following tabulation gives some general figures showing the approximate amount of light required at various locations in and around passenger stations:

First Class—Important City and Suburban Stations

| | | | |
|---|---|---|---|
| Waiting room | Direct | 3 to 3.5 | foot candles |
| Ticket office | Direct | 3.5 to 4.5 | " " |
| Ticket windows | Direct, 1 drop | 4 to 4.5 | " " |
| Baggage room | General illumination | 1 to 2 | " " |
| | With local drop over desk and window. | | |
| News stand | Direct illumination | 5 | foot candles |
| Toilet rooms | Direct general illumination | 1.5 to 2 | foot candles |
| | With one drop over each two stalls. | | |
| Coversheds and main platforms | Direct | 1.5 | foot candles |
| Outlying platforms | Direct | 1 | " " |
| Station approaches | Direct | 1 to 1.5 | " " |

Second Class—Unimportant Country Stations

| | | | |
|---|---|---|---|
| Waiting room | Direct general illumination | 3 | foot candles |
| Ticket office | Direct general illumination | 3.5 | " " |
| Ticket window | One 25-watt lamp | 4 | " " |
| Baggage room | Direct illumination (1 or more drop) | | |
| Toilet room | Direct (generally 1 drop is sufficient) | | |
| Platforms adjacent to station | Direct | 0.1 to 1.5 | foot candles |
| Outlying platforms | Direct | 0.25 to 5 | " " |

### Subject (8). Modern Types of Toilet Facilities at Small Stations Where Water Supply and Sewers Are Lacking

Within the past five or six years, a number of waterless closets have come on the market and some of them are proving a very satisfactory substitute for the privies, doing away with the odor and pollution, and they can be installed in any building at a cost no greater than for a single or double privy. In a great many instances they will answer the purposes that water fixtures are designed for, and are more economical to install and operate, being practically non-freezing, free from the usual plumbing charges, and do not waste water. They are easily cleaned, swabs being furnished for the purpose.

This system consists of a receiving receptacle containing chemicals, which destroy any disease germs and liquefy the fecal matter. This container can be pumped or drained on the ground, as there is no odor and all germs are destroyed. If fixtures are installed in proper proportion to the number of people served it will only be necessary to drain the receptacle approximately once every three months. One fixture will serve approximately 20 persons per day.

On account of the chemicals necessary in this system, special attention should be given to the quality of material used. In no case should less than 14 gage metal be considered and pure iron should be used. The tank and tubes should also be coated with asphaltic enamel, which adheres to metal under bending and will be unaffected by acids, alkalis, electrolytic or atmospheric conditions.

Another type obtainable is a portable container with seat and lid, agitator, and an anti-splash board which takes position when the seat is raised, which assists in agitation.

In regard to the experience of the railroads with these fixtures, a questionnaire was sent out and the 50 odd replies received show that 24 roads have no installations. Others show installations of from 1 to 354 with only a few renewals, mostly from corrosion of tank, but in one case from lack of attention. The installations cover a period of from 1913 to 1919.

The opinion, therefore, seems to be that with proper installation and attention chemical toilets are satisfactory.

### Conclusions

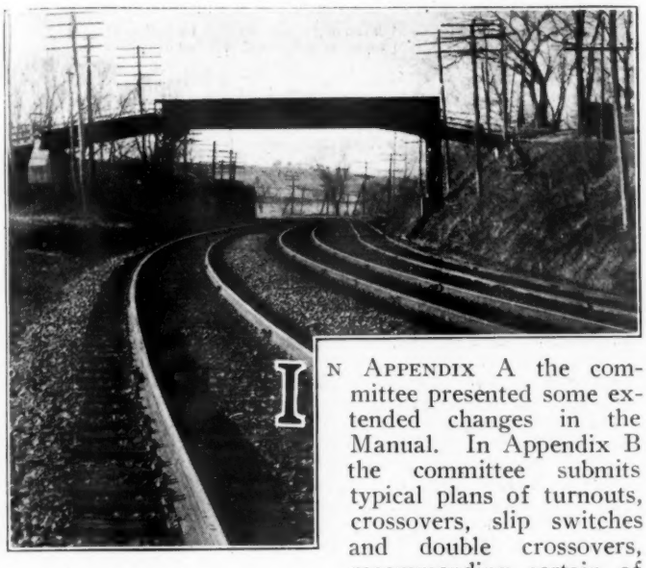
It is recommended that in locations where water supply and sewers are available, the usual system of water closets and urinals be installed. Where these are not available permanent or portable types of chemical closets and urinals should be installed; proper supervision of installation, care in inspection, handling, charging and draining should be maintained.

Committee: M. A. Long (architect), chairman; C. W. Richey (P. R. R.), vice-chairman; G. W. Andrews (B. & O.), D. R. Collin (architect), W. H. Cookman (P. R. R.), C. G. Delo (C. G. W.), W. T. Dorrance (N. Y., N. H. & H.), K. B. Duncan (A. T. & S. F.), G. H. Gilbert (Sou.), Walter Goldstraw (G. T.), A. T. Hawk (C. R. I. & P.), F. F. Harrington (U. S. R. A.), E. A. Harrison (A. T. & S. F.), A. Larsen (Miami Conservatory), J. W. Orrock (C. P. R.), R. V. Reamer (C. R. R. of N. J.), John Schofield (C. N.).

### Discussion

In the absence of Chairman Long, A. T. Hawk (C. R. I. & P.) presented the report, and moved that the revisions of the Manual as proposed by the committee be approved. The motion was seconded and carried. Mr. Hawk read the conclusions at the end of the report on Subject 7, and made a motion that these conclusions, including the tables, be published in the Manual. This was seconded and carried. He then read the matter relating to Subject 8 and the conclusions at the end of the report, which were adopted. The committee was then excused.

# Report of the Committee on Track



IN APPENDIX A the committee presented some extended changes in the Manual. In Appendix B the committee submits typical plans of turnouts, crossovers, slip switches and double crossovers, recommending certain of them for adoption and others to be received as information. These plans were the result of the study and co-operation of the committee and the frog and switch manufacturers of the Manganese Track Society. In Appendix C the committee presented a specification for relayer rail, which classifies the rail according to wear and grades it according to the use intended.

The committee reported progress on: Subject 3—"Report on reduction of taper of tread of wheel to 1 in 38, and on canting the rail inward"; Subject 4 (a)—"Report on test of tie plates subject to brine drippings," and on Subject 6—"Continue efforts to induce railroad operating officials to study and collect data relating to effect of flat spots on track structure."

## Conclusions

1. The committee recommended that the changes in the Manual in Appendix A be approved and the revised matter be substituted for the present subject-matter in the Manual.

2. The committee recommended 41 "Typical Plans for Frogs, Switches, Turnouts, Crossovers," etc., for approval and publication in the Manual as listed in Appendix B; also Specifications for the Design and Dimensions of Manganese Steel Pointed Switches, printed in Vol. 18, A. R. E. A. Proceedings of 1917, page 407.

The committee also recommended that 13 plans, dated September 15, 1919, be accepted as information as listed in Appendix B; also 8 plans giving preferred names of parts, as listed in Appendix B.

The committee recommended the reassignment of Subject 2—"Report on typical plans of turnouts, crossovers, slip-switches and double crossovers, and prepare details for such work"; Subject 3—"Report on reduction of taper of tread of wheel to 1 in 38, and on canting the rail inward"; Subject 4 (a)—"Report on test of tie plates subject to brine drippings"; and 4 (b)—"Report on the effect of brine drippings on track appliances." It recommended the discontinuance of Subject 6—"Continue efforts to induce railroad operating officials to study and collect data relating to effect of flat spots on track structure," and that an investigation of the effect of flat spots on track structure be made by the Committee on Stresses in Track.

Committee: W. P. Wiltsee (N. & W.), chairman; J. R. Leighty (M. P.), vice-chairman; R. A. Baldwin (C. N. R.), Geo. H. Bremner (I. C. C.), G. W. Hegel (C. J), T. H. Hickey (M. C.), E. T. Howson (Railway Age), T. T. Irving (G. T.), J. B. Jenkins (B. & O.), H. A. Lloyd (Erie), J. de N. Macomb (A. T. & S. F.), F. H. McGuigan, Jr. (U. S. R. A.), J. V. Neubert (N. Y. C.), F. L. Nicholson (N. S.), C. H. Niemeyer (P. R. R.), R. M. Pearce (P. & L. E.), H. T. Porter (B. & L. E.), J. H. Reinholdt (M. & St. L.), G. J. Slibeck (Pettibone Mullikin Co.), J. B. Strong (Ramapo Iron Works), J. R. Watt (L. & N.).

## Appendix A—Revision of Manual

The committee recommended that the following changes in the Manual be made:

### SPECIFICATIONS

For Specifications for Steel Tie Plates, Specifications for Wrought-Iron Tie Plates, Specifications for Malleable Iron Tie Plates, Specifications for Ordinary Track Spikes and Specifications for Screw Spikes, substitute the following specifications: The Specifications for Track Bolts on page 123 of the Manual should be withdrawn, as the Rail committee is now handling this subject. The committee is of the opinion that the Specifications for Spiral Spring Nut Locks should be withdrawn and the subject handled by the Rail committee in connection with joints and bolts.

The committee recommends that the design of the cut track spike shown on page 22 of the 1918 Supplement to the Manual be withdrawn, and the design submitted herewith be substituted therefor, as the present design in the Manual does not correctly show the slope of the under-

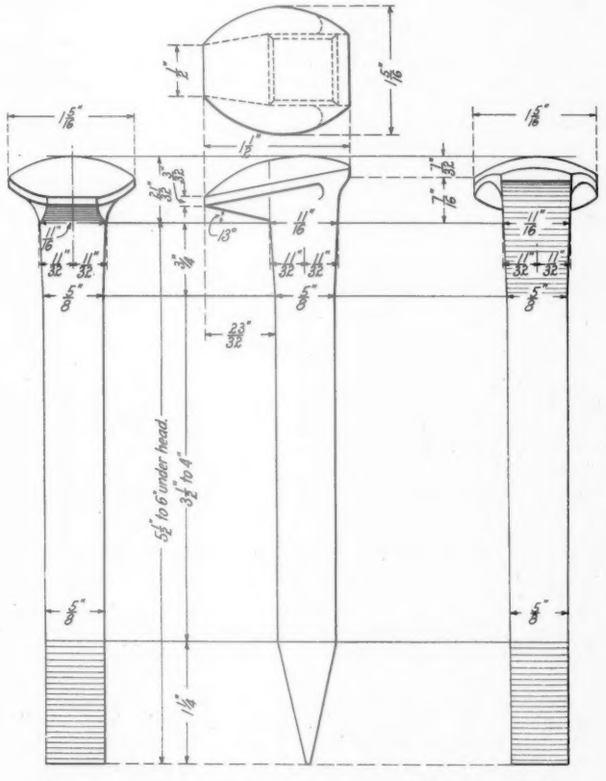



**Fig. 1—Recommended Design of a Cut Track Spike**

side of the head of the spike to agree with the slope of the top of the rail base.

### FROGS, SWITCHES, ETC.

It is recommended that the plans shown on pages 169, 170 and 171 of the Manual, and that paragraphs on Frog

Blocking and the Specifications for Frogs, Crossings and Switches and Turnouts, Crossovers, etc., shown in the 1915 Manual on pages 172 to 186, inclusive, be withdrawn from the Manual until new specifications can be provided to agree with the recommended plans of frogs and switches. These plans in themselves contain sufficient specifications for temporary purposes.

## Specifications for Steel Cut Track Spikes

### I. Material

**Process.** 1. The steel may be made by Bessemer or open-hearth process.

### II. Physical Requirements

**Tension Tests.** 2. The full-size finished spikes, or the full-size bars from which the spikes are made, shall conform to the following minimum requirements as to tensile properties:

Tensile strength, lb. per sq. in.....55,000
Yield point, lb. per sq. in.....0.5 tensile strength
Elongation in 2 in., per cent.....25.

**Bend Tests.** 3. (a) The body of the full-size finished spikes shall bend cold through 180 deg. flat on itself, without cracking on the outside of the bent portion.

(b) The head of the full-size finished spikes shall bend backward to the line of the face of the spike, without cracking on the outside of the bent portion.

**Number of Tests.** 4. (a) One tension and one bend test of each kind shall be made from each lot of 10 tons or fraction thereof.

(b) If any test specimen develops flaws, it may be discarded and another specimen substituted.

**Retests.** 5. If any tension test specimen breaks more than ¾ in. from the center of the gage length, a retest shall be allowed.

### III. Design

**Workmanship.** 6. The spikes shall conform to the dimensions specified by the purchaser. A variation of 1/64 in. under the specified dimension of the body of the spike, measured from the face to the back, and a variation of 1/32 in. over the specified dimensions of the body of the spike, measured across the face, will be permitted. A variation of 3/32 in. over and 1/32 in. under the specified dimensions of the head of the spike will be permitted. A variation of ⅛ in. from the specified length of the spike, measured from the under side of the head to the point, will be permitted. A variation of 1 deg. in the specified angle of the under side of the head of the spike will be permitted.

### IV. Manufacture

**Finish.** 7. The finished spikes shall be free from injurious defects and shall have a workmanlike finish.

### V. Inspection

**Inspection.** 8. The inspector representing the purchaser shall have free entry, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's work which concern the manufacturer of the spikes ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the spikes are being furnished in accordance with these specifications. All tests and inspection shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

**Rejection.** 9. Spikes which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

### VI. Shipment

**Packing.** 10. When spikes are shipped they shall be packed in good, serviceable packages. All packages must be plainly marked as to material, size of spike and name of manufacturer.

## Specifications for Steel Tie Plates

1. These Specifications cover two grades of steel tie plates, namely, Soft and Medium. The soft grade steel shall be used, unless otherwise specified.

### I. Material

**Process.** 2. Steel may be made by the Bessemer or open-hearth process.

### II. Chemical Requirements

**Phosphorus.** 3. (a) The steel shall conform to the following requirements as to chemical composition:

Phosphorus..... { Bessemer—not over 0.10 per cent.
{ Open-hearth—not over 0.05 per cent.

**Carbon.** (b) Unless otherwise specified, the material will be furnished according to chemical composition only, in which case the minimum carbon shall be as follows:

| | | |
|---|---|---|
| Bessemer | Soft Grade | Medium Grade |
| Carbon | Not under 0.08 per cent. | Not under 0.12 per cent. |
| Open-hearth | Soft Grade | Medium Grade |
| Carbon | Not under 0.15 per cent. | Not under 0.20 per cent. |

**Ladle Analysis.** 4. (a) A carbon determination shall be made of each melt of Bessemer steel, and two analyses every 24 hours representing the average of the elements, carbon, manganese, phosphorus and sulphur, contained in the steel, one for each day and night turn, respectively. These analyses shall be made from drillings taken at least ⅛ in. beneath the surface of a test ingot obtained during the pouring of the melts. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified in Section 3.

(b) An analysis of each melt of open-hearth steel shall be made by the manufacturer to determine the percentages of carbon, manganese, prosphorus and sulphur. This analysis shall be made from drillings taken at least ⅛ in. beneath the surface of a test ingot obtained during the pouring of the melt. The chemical composition thus determined shall be reported to the purchaser or his representative, and shall conform to the requirements specified in Section 3.

**Check Analysis.** 5. An analysis may be made by the purchaser from a finished tie plate representing each melt of open-hearth steel, and each melt or lot of 10 tons of Bessemer steel. The carbon content thus determined shall not be less than that specified in Section 3, and the phosphorus content shall not exceed that specified in Section 3 by more than 25 per cent.

### III. Physical Requirements

**Bend Test.** 6. The bend test specimens specified in Section 7 shall bend cold through 180 deg. around a pin the diameter of which is equal to the thickness of the specimen for the soft grade, and to twice the thickness of the specimen for the medium grade, without cracking on the outside of the bent portion.

**Test Specimens.** 7. Bend test specimens shall be taken from the finished tie plates, or from the rolled bars, and longitudinally with the rolling. They shall be rectangular in section, not less than ½ in. in width between the planed sides, and shall have two parallel faces as rolled. They shall be free from ribs or projections. Where the design of the tie plates is such that the specimen cannot be taken between the ribs or projections, these ribs or projections shall, in preparing the specimen, be planed off even with the main surface of the tie plate.

**Optional Bend Test.** 8. If preferred by the manufacturer and approved by the purchaser, the following bend test may be substituted for that described in Section 6.

A piece of the rolled bar shall bend cold through 90 deg. around a pin the diameter of which is equal to the thickness of the section, where bent for the soft grade, and to twice the thickness of the section where bent for the medium grade, without cracking on the outside of the bent portion.

**Number of Tests.** 9. (a) One bend test shall be made from each melt of open-hearth steel, or from each melt or lot of 10 tons of Bessemer steel.

(b) If any test specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

**Tension Tests.** 10. (a) If desired by the purchaser or for the reason that the manufacturer does not make his own steel bars and is not able to make the chemical analysis of the steel, the material may be purchased to conform to the following minimum requirements as to tensile properties:

| | Soft Grade | Medium Grade |
|---|---|---|
| Tensile strength, lb. per sq. in. | 55,000 | 64,000 |
| Yield point, lb. per sq. in. | 0.5 tens. str. | 0.5 tens. str. |
| Elongation in 2-in., per cent. | 1,500,000 | 1,500,000 |
| | Tensile St. | Tensile Str. |
| But in no case less than | 20 per cent. | 18 per cent. |
| Elongation in 8-in., per cent. | 1.400.000 | 1,400,000 |
| | Tensile St. | Tensile Str. |
| But in no case less than | 18 per cent. | 16 per cent. |
| Reduction of area, per cent. | 30 per cent. | 25 per cent. |

**Test Specimens.** (b) The tension test specimens shall be taken from the finished tie plates, or from the rolled bar. They shall be cut so that the sides of the specimens are parallel to the direction in which the tie plates have been rolled.

(c) Tension test specimens may conform to the essen-

tial dimensions shown in Fig. 2 or Fig. 3. The 2-in. specimen (Fig. 1) shall have filleted shoulders, or threaded ones, to fit into the holders on the testing machine in such a way that the line of action of the force exerted by the testing machine shall coincide with the axis of the specimen.

Note:—The gage length, parallel portions and fillets shall be as shown, but the ends may be of any form which will fit the holders of the testing machine.

(d) Or, tension test specimens may be rectangular in section, in which case they shall be not less than ½ in. in width between the planed sides, and shall have two parallel faces as rolled. When the tie plates are of such a design that the rectangular specimens cannot be obtained without projecting ribs, these shall be planed off before the tests are made.

**Number of Tests.** 11. (a) One tension test shall be made from each melt of open-hearth steel, and from each melt or lot of 10 tons of Bessemer steel.

(b) If any test specimen shows defective machining, or

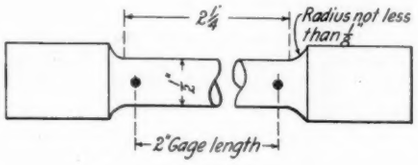



**Fig. 2**

develops flaws, or if it breaks outside the gage length, it may be discarded and another specimen substituted.

**Retests.** 12. If the percentage of elongation of any tension test specimen is less than that specified in Section 5, or if any part of the fracture is more than ¾ in. from the center of the gage length of a 2-in. specimen or is outside the middle third of the gage length of an 8-in. specimen, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

### IV. Design

**Plan.** 13. The tie plates shall conform to the drawings submitted to the manufacturer, with the following permissible variations:

**Tolerance.** (a) For plates with shoulders parallel to the direction of rolling, a variation of 1/32 in. in thickness, ⅛ in. in rolled width, and 3/16-in. in sheared length will be permitted.

(b) For plates with shoulders perpendicular to the direction of rolling, a variation of 1/32-in. in thickness, ⅛-in. in rolled width, and ¼ in. in sheared length will be permitted. The distance from the face of shoulder to the outside end of the plate shall not vary more than ¼ in., and from the face of shoulder to the inside end not more than ½ in.

### V. Manufacture

**Workmanship.** 14. The tie plate shall be smoothly rolled, true to templet, and shall be straight and out of wind on the surface which will form the bearings for the rail.

**Finish.** 15. The finished tie plates shall be free from burrs and other surface deformations caused by the shearing and punching; they shall also be free from other injurious defects and shall have a workmanlike finish.

**Marking.** 16. The name or brand of the manufacturer the section and the year of manufacture shall be rolled in raised letters and figures on the outside of the shoulder of the plates, and a portion of this marking shall appear on each finished tie plate.

### VI. Inspection

**Inspection.** 17. (Same as for track spikes.)

**Rejection.** 18. (a) Unless otherwise specified, any rejection based on tests made in accordance with Section 5 shall be reported within five working days from the receipt of samples.

(b) Tie plates which show injurious defects subsequent to their acceptance at the manufacturer's works will be rejected, and the manufacturer shall be notified.

**Rehearing.** 19. Samples tested in accordance with Section 5, which represent rejected tie plates, shall be preserved for two weeks from the date of the test report. In case of dissatisfaction with the results of the tests, the manufacturer may make claim for a rehearing within that time.

### VII. Shipment

**Packing.** 20. Tie plates shall be wired together in bundles of uniform number, weighing not to exceed 100 lb., unless otherwise specified.

## Specifications for Steel Screw Track Spikes

### I. Material

**Process.** 1. (Same as for cut spikes.)

**Finishing.** 2. The heads of the spikes shall be formed and the threads rolled at a temperature not less than 750 deg. C.

### II. Physical Requirements

**Tension Tests.** 3. The full-sized finished spikes shall conform to the following minimum requirements as to tensile properties:

| | |
|---|---|
| Tensile strength, lb. per sq. in. | 60,000 |
| Yield point, lb. per sq. in. | 0.5 tensile strength |
| Elongation in 2 in., per cent | 20 |

**Bend Tests.** 4. The full-size finished spikes shall bend cold through 90 deg. around a pin the diameter of which is equal to three times the diameter of the spike, without cracking on the outside of the bent portion.

**Number of Tests.** 5. (a) One tension and one bend test shall be made from each lot of 100 kegs or fraction thereof.

(b) If any spike tested develops flaws, it may be discarded and another spike substituted.

**Retests.** 6. (a) If the percentage of elongation of any tension test spike is less than that specified in Section 3, a retest shall be allowed.

(b) If any tension test spike breaks more than ¾ in. from the center of the gage length, a retest shall be allowed.

### III. Design

**Workmanship.** 7. The spikes shall conform to the dimensions specified by the purchaser. The head shall be concentric with, and firmly joined to the body of the spike. The threads shall be sharp and true to gage and of the pattern specified by the purchaser. A variation of 1/32 in. over the specified diameter of the unthreaded portion of the body of the spike will be permitted. A variation of 1/32 in. over the specified diameter of the threaded portion of the spike will be permitted. A variation of 1/16 in. under and ⅛ in. over in the reach of the head of the spike will be permitted. A variation of ⅛ in. from the specified length of the spike will be permitted.

### IV. Manufacture

**Finish.** 8. (Same as cut spike.)

**Marking.** 9. A letter or brand indicating the manufacturer shall be pressed on the head of the spike while it is being formed.

### V. Inspection

**Inspection.** 10. (Same as for cut spike.)

**Rejection.** 11. (Same as cut spike.)

### VI. Shipment

**Packing.** 12. When spikes are shipped they shall be properly oiled to prevent rusting and shall be packed in good, serviceable packages. All packages shall be plainly marked

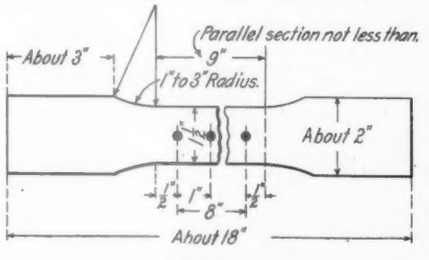



**Fig. 3**

as to material, size of spike and name of manufacturer, unless otherwise specified.

## Specifications for Wrought-Iron Tie Plates

### I. Material

1. Plates shall be made of all-pig puddled iron.

### II. Physical Requirements

2. The material shall conform to the following minimum requirements as to tensile properties:

| | |
|---|---|
| Tensile strength, lb. per sq. in. | 48,000 |
| Yield point, lb. per sq. in. | 0.6 tensile strength |
| Elongation in 2-in., per cent | 28 |
| Elongation in 8-in., per cent | 25 |
| Reduction of area, per cent | 37 |

**Bend Tests.** 3. The bend test specimen shall bend cold through 180 deg. without fracture around a pin the diameter of which is equal to the thickness of the specimen.

**Test Specimens.** 4. (Same as for steel tie plate.)

**Number of Tests.** 5. (a) One tension test and one bend test shall be made from each lot of 1,000 tie plates.

(b) If any test specimen from either of the bars originally selected to represent a lot of material contains surface defects not visible before testing, but visible after testing, or if a tension test specimen breaks outside the middle third of the gage length, the individual bar shall be rejected and one retest from a different bar will be allowed.

### III. Design

**Plan.** 6. (Same as for steel tie plate.)

**Variations.** (Same as for steel tie plate.)

### IV. Manufacture

**Workmanship.** 7. (Same as for steel tie plate.)

**Finish.** 8. The finished tie plates shall be free from burrs and other surface deformations caused by the shearing and punching; they shall also be free from slivers, depressions, seams, crop ends and evidences of being burnt.

**Marking.** 9. (Same as for steel tie plate.)

### V. Inspection

**Inspection.** 10. (Same as for steel tie plate.)

**Rejection.** 11. If either of the test bars selected to represent a lot does not conform to the requirements specified in Sections 2, 3, 4 and 5, the lot will be rejected.

### VI. Shipment

**Packing.** 12. (Same as steel tie plate.)

## Specifications for Malleable Iron Tie Plates

### I. Material

1. Plates shall me made from furnace malleable iron.

### II. Physical Requirements

**Tension Tests.** 2. The tension test specimens specified in Section 4 shall conform to the following minimum requirements as to tensile properties:

| | |
|---|---|
| Tensile strength, lbs. per sq. in. | 45,000 |
| Elongation in 2 in., per cent | 7.5 |

**Special Tests.** 3. (a) All tie plates shall have cast thereon test lugs of a size proportional to the thickness of the tie plate, but not exceeding ⅝ by ¾ in. in cross-section. These lugs shall be attached to the tie plate at such a point that they will not interfere with the assembling of the tie plates, and may be broken off by the inspector.

(b) If the purchaser or his representative so desires, a

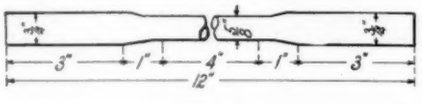



**Fig. 4**

tie plate may be tested to destruction. Such a tie plate shall show good, tough, malleable iron.

**Tension Test Specimens.** 4. (a) Tension test specimens shall be of the form and dimensions shown in Fig. 4. Specimens whose mean diameter at the smallest section is less than 19/32 in. will not be accepted for test.

(b) A set of three tension test specimens shall be cast from each melt, without chills, using risers of sufficient height to secure sound bars.

The specimens shall be suitably marked for identification with the melt. Each set of specimens so cast shall be placed in some one oven containing tie plates to be annealed.

**Number of Tests.** 5. (a) After annealing, three tension test specimens shall be selected by the inspector as representing the tie plates in the oven from which these specimens are taken.

(b) If the first specimen conforms to the specified requirements, or if, in the event of failure of the first specimen, the second and third specimens conform to the requirements, the tie plates in that oven shall be accepted, except that any tie plate may be rejected if its test lug shows that it has not been properly annealed. If either the second or third specimen fails to conform to the requirements, the entire contents of that oven shall be rejected.

**Re-annealing.** 6. Any tie plates rejected for insufficient annealing may be re-annealed once. The re-annealed tie plates shall be inspected and if the remaining test lugs, or tie plates broken as specimens, show the tie plates to be thoroughly annealed, they shall be accepted; if not, they shall be finally rejected.

### III. Design

**Plan.** 7. Tie plates shall conform to the drawing submitted to the manufacturer, with the following permissible variations:

**Variation.** (a) The length and width shall not vary more than ⅛ in. from the dimensions shown.

(b) The thickness shall not vary more than 1/32 in. from the dimensions shown.

### IV. Manufacture

**Workmanship.** 8. The plates shall be straight and out of wind on the surface which forms the bearings for the rail, and shall be made in workmanlike manner.

**Finish.** 9. The finished tie plate shall be well cleaned and free from warping, shrinkage, cracks, blow-holes, fins, and other imperfections.

**Marking.** 10. The manufacturer's identification mark and the pattern numbers assigned by the purchaser shall be cast on all tie plates in such positions that they will not interfere with the service of the tie plate.

### V. Inspection

**Inspection.** 11. (Same as for steel tie plates.)

(b) The manufacturer shall be required to keep a record of each melt from which tie plates are produced, showing tensile strength and elongation of test specimens cast from such melts. These records shall be available and shown to the inspector whenever required.

**Rejection.** 12. Tie plates which show injurious defects subsequent to their acceptance at the manufacturer's works may be rejected, and, if rejected, shall be replaced by the manufacturer free of cost to the purchaser.

### VI. Shipment

**Packing.** 13. (Same as for steel tie plates.)

Tie plates shall be wired together in bundles of uniform number, weighing not to exceed 100 pounds, for shipment, unless otherwise specified.

## Appendix B—Typical Plans of Turnouts, Crossovers, Etc., with Detail Plans for Such Work, Including Tie Plates, Rail Braces, Etc.

The committee submitted detail plans with recommendations for adoption as follows:

Plans Dated September 15, 1919.

| | |
|---|---|
| Plans 101 to 108, inclusive | Details of Switches. |
| Plans 201 to 204, inclusive | Details of Switch Fixtures. |
| Plans 210 and 211 | Illustration Bills of Material for Switches. |
| Plans 301, 302, 303, 304, 306 and 307 | Bolted Rigid Frogs. |
| Plans 305 and 308 | Details of Plates for Bolted Rigid Frogs. |
| Plans 401, 402 and 403 | Spring Rail Frogs. |
| Plan 501 | Details of Guard Rails. |
| Plan 502 | Details of Guard Rail Fixtures. |
| Plans 601 to 607, inclusive | Railbound Manganese Steel Frogs. |
| Plans 651 to 655, inclusive | Solid Manganese Steel Frogs. |

Also the specifications for the Design and Dimensions of Manganese Steel Pointed Switches, as printed in Vol. 18, A. R. E. A., Proceedings of 1917, on page 407.

### Plans of Frogs, Switches, Etc.

These plans will be found complete for 11 ft. 0 in., 16 ft. 6 in., 22 ft. 0 in. and 30 ft. 0 in. split switches, also with Specifications for the Design and Dimensions of Manganese Steel Pointed Switches of these lengths: for bolted rigid frogs Nos. 6, 7, 8, 10, 11 and 16; for spring rail frogs Nos. 8, 10 and 11; for guard rails 8 ft. 3 in., 11 ft. 0 in. and 16 ft. 6 in. long; for railbound manganese steel frogs Nos. 6, 7, 8, 10, 11, 16 and 20, and for solid manganege steel frogs Nos. 6, 7, 8, 10 and 11.

It is recognized it would not be economical for some of the railroad systems to adopt this set of standards throughout on account of local or other conditions, but this set of standards will form a guide in making up new plans, especially when a change in rail section is contemplated. The fittings as detailed could then be largely adopted, which would prove of considerable economy, as the manufacturers could afford to carry material of

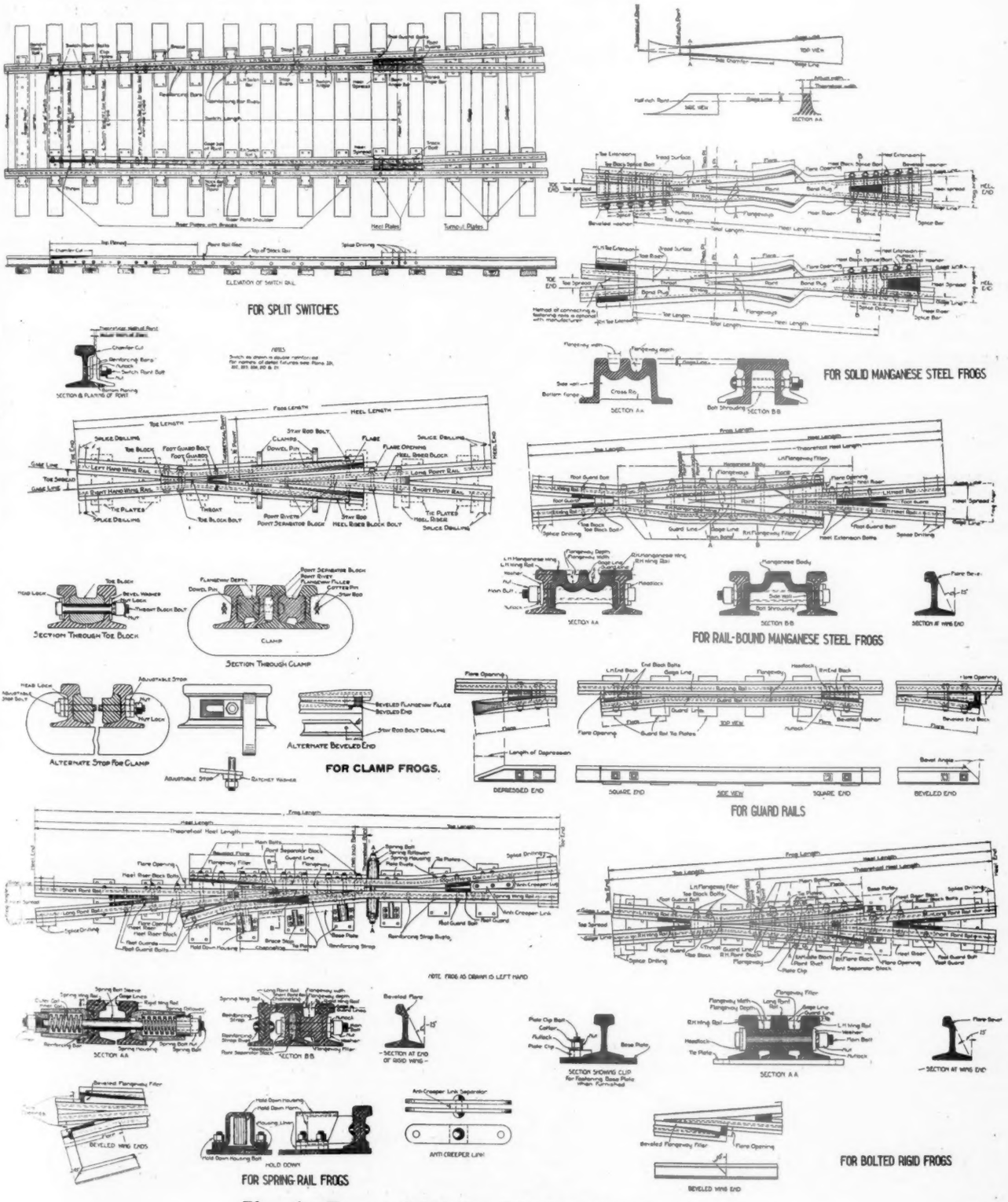
standard sizes and to make up the standard fittings in quantity and carry them in stock.

The committee also submitted as information plans dated September 1, 1919, as follows:

Plans 331 to 334, inclusive..Clamp frogs.
Plan 335 .....Details of plates for clamp frogs.
Plans 901 to 908, inclusive..Layout plans of turnouts and crossovers.
Plan 190—Split switch with uniform risers.
Plan 191—Split switch with graduated risers.
Plan 390—Bolted rigid frog.
Plan 391—Clamp frog.
Plan 490—Spring rail frog.
Plan 590—Guard rail.
Plan 690—Railbound manganese steel frog.
Plan 691 Solid manganese steel frog.

The committee also submitted a report from a questionnaire sent out on July 25, 1919, "Subject—Design and Use of Clamp Type of Frog," to the members of this association, reading as follows:

1. Do you use the clamp type of frog?




**Plans for Frogs and Switches Submitted by Track Committee**

2. Have you ever used the clamp type of frog? If so, and you are not using it, why was its use discontinued?
3. With what weight of rail and what frog angles was this type of frog used?
4. In your opinion, how does this frog compare with the bolted rigid type of frog?
5. Please give mileage of track and number of switches using this type of frog and approximate percentage of the total number of frogs used that are of the clamp type.

Summarizing the reports from the 62 roads replying, comprising 193,561 miles of road operated, the report is as follows:

1. Six roads representing 15,620 miles of road reported a "Yes." one of which reported very few used.
2. Thirty-two railroads comprising 106,869 miles of road reported having used them.

Eight railroads, comprising 12,547 miles, did not state.

3. Very few roads gave the weight and frog angle and what type of frog used, but those that did state claim the majority of them were all weights of rail, 80 lb. and under, and frog angles from No. 7 to No. 10, inclusive.
4. Twenty-nine railroads comprising 80,810 miles of road reported the clamp frog is inferior to the bolted rigid frog.

Four railroads, comprising 12,946 miles of road, reported the clamp frog as superior to the bolted rigid frog.

Five railroads, comprising 8,288 miles of road, reported the clamp frog as comparing favorably to the bolted rigid frog.

Twenty-four railroads, comprising 91,517 miles of road, reported not having used clamp frogs and gave no opinion.

5. The roads reporting did not give sufficient information to work up this data, but the majority of them said where they are being used they are used in yards and sidings only.

## Appendix C—Report on Specifications for Relayer Rails for Various Uses

The committee submitted specifications for relayer rails for various uses:

**Definition.** Worn rails suitable for use in track are known as relayer rails.

**Classification.** Relayer rails shall be classified according to the wear on the side and top of the head:

(1) Side wear shall be represented by figures, 0 representing no side wear, 1, 2, 3, etc., representing the number of sixteenths of an inch wear on the side of the head at the gage point 5/8 in. below the original top of the rail.

(2) Top wear shall be represented by capital letters, O representing no top wear, A representing 1/32 in., B, 2/32 in., C, 3/32 in., etc., wear, measured at the center of the rail.

(3) If the rail head is worn on both sides the first figure shall represent the side showing the greater wear, the letter the top wear, and the figure following the lesser side wear.

(4) The maximum wear allowed in each case shall be specified by the user or the purchaser.

**Process and Section.** The process, as Bessemer, open-hearth, special alloy or process steel, the section, the original weight per yard and the splice drilling shall be specified.

**Main Track Relayer Rails.** *Grade* 1. Used rails suitable for main track on main or branch lines. They must be free from all physical defects and shall pass the A. R. E. A. Specifications for Steel Rail in all respects except wear. The surface of the rails of this grade must be fairly smooth and must not have flat spots or wheel burns. They must be sawed at the ends, not cut with a chisel. Drilling must be uniform. Chemical analysis or the specifications under which the rails were originally purchased shall be furnished when requested by the purchaser. There shall be full length pieces, 30 or 33 ft. long, and not over 10 per cent of shorts varying in lengths by 1 ft. with a minimum length of 22 ft.

**Resawing Rails.** *Grade* 2. All rails with battered or otherwise defective ends, which if resawed would meet Grade 1 requirements, shall be graded as Resawed Main Track Relayer Rails. In this case 90 per cent of the rails must be of uniform length, 27 ft. or more.

**Side Track Relayer Rails.** *Grade* 3. All used rails suitable for side tracks shall be included in this grade. They must be not less than 15 ft. long. Rails too badly out of line or surface to be included in Grade 1, but straight enough to be easily spiked to line and gage shall be accepted. Drilling must be uniform. Base must be full or uniform width.

Any physical defects, such as broken lower flange, corroded, curved ends, burnt, ends battered, ends down, flat spots, head flow, line bent, piped, pitted, short, split end, split head, surface bent, twisted worn under head, shall be specified where they occur and the extent of the defect shall be represented by the use of the term "slight," "moderate" or "bad."

**Scrap Rails (Rolling Mill Rails).** *Grade* 4. Rails of standard section not suitable for use as relayer rails. They shall be not less than 6 ft. long and must be free from pipes, split heads and similar defects. Badly twisted rails or bent rails, frogs, switches and guard rails shall not be accepted.

**Scrap Rails.** *Grade* 5. All used rails of any length or condition not meeting the above specifications shall be designated as Grade 5.

**Marking and Shipping.** Rails when classified shall be marked with white paint on the web about 3 ft. from the end. The figure and letter representing the side and top wear shall be painted first, followed by a dash (—) and the grade number, except scrap rails shall be marked by the grade number only. No two grades of rails shall be loaded in the same car.

**Examples.** (1) Main track relayer rails having 3/16 in. side wear and 3/32 in. top wear would be classified and marked 3 C—1.

(2) Resawed main track relayer rails having 1/4 in. side wear and 3/32 in. top wear would be classified and marked 4 C—2.

(3) Side track relayer rails having 1/2 in. side wear and 1/8 in. top wear would be classified and marked 8 D—3. If there are any physical defects, as curved ends, line bent, pitted, etc., they should be so classified and the extent of the defects specified as "slight," "moderate" or "bad."

(4) Side track relayer rails having 1/2 in. side wear on one side and 3/8 in. side wear on the other side, 1/8 in. top wear, would be classified and marked 8 D 6—3. If there are any physical defects, as curved ends, line bent, pitted, etc., they should be so classified and the extent of the defects specified as "slight," "moderate" or "bad."

### Discussion

W. P. Wiltsee (Chairman): I move that the design of the track spike as shown in the report be adopted and printed in the Manual.

W. C. Cushing (P. R. R.): I have had some correspondence with some manufacturers on this design of spike, and two of them have written to me that it requires special machines for its manufacture, which adds to its cost. The trouble is it must be a hand-made spike instead of a machine-made spike. I therefore would move as an amendment that this question be taken up further before it is presented to the association for adoption.

(The amendment was seconded.)

Chairman Wiltsee: That question was up before this spike was accepted. Two years ago I took it up with manufacturers, and it was proved to me that they could manufacture this spike as economically as any other spike on automatic machines. The Canadian Pacific has been using this spike for a long time. I was told that the Central Railroad of New Jersey had recently purchased some of these spikes, and I think the matter has been fully investigated, and that there isn't any doubt but what it can be manufactured.

Mr. Cushing: There is doubt on the question. I have these letters and will be pleased to submit them if desired. It seems to me if there is any doubt it had better be looked into further.

F. E. Abbott (Lackawanna Steel Company): The Lackawanna Steel Company's criticism of this spike was, first, that there is an enlargement of the entire outside under the head, and it is 1/16 in. larger at the top and the enlargement is put on all sides of the spike. That will be the most difficult part to make in an automatic machine, the enlargement on top of the spike.

Clark Dillenbeck (P. &. R.): Our spikes were ordered a couple of months ago in accordance with the standard from Davis Bros. & Co. of Philadelphia, and they came in and said it was impossible to make them in their machines and we changed the design to satisfy them.

(Mr. Cushing's amendment was put and carried.)

Chairman Wiltsee: I move that the specification for steel cut track spike appearing on page 153 be adopted and printed in the Manual.

(The motion was seconded and carried.)

Chairman Wiltsee: The next specification is that for steel tie plates. I move that this specification be adopted and printed in the Manual.

(Motion seconded.)

Mr. Abbott: I would like to know definitely whether it is the intention that both the chemical and the physical tests shall be applied. It is not quite clear as the specification reads that it is left optional with the purchaser. If it is optional with the purchaser, he can require it at all times, and on all material specifications. That is an unfortunate situation in a sense. The manufacturers favor a grade of steel that will make an outlet for the soft grade; that is, they need it for the sake of economy as much as for anything else, and there are a great many tie plates used in which the soft grade is particularly satisfactory.

Now, to get over that difficulty it would seem fair that there might be named in the specification a soft grade, without any minimum limit on the carbon. You do not necessarily get poor steel because it is soft steel. You simply get soft steel. If you have a pattern of tie plate that is so thick that you cannot punch it until you get the carbon away down, you have got to make an agreement with the buyer to do something different from what the specification calls for.

We are frequently called on to punch a plate that has a greater thickness than the diameter of the hole, and the mechanical department will always back up on it. If this Association puts up a specification that runs up the cost on the manufacturer, or is so exacting in the specifications as to make it more expesive for the manufacturer, you are going to lose the benefit of what you might get by opening the way for the consumption of steel that is fit for a greater part of the tie plates that are required.

Chairman Wiltsee: I think the tendency is to go to higher grade steel in tie plates rather than to allow the manufacturers to use soft steel. The tie plate is becoming a more and more important article and requires more attention than it has had heretofore.

C. W. Baldridge (A. T. & S. F.): I notice the committee permits a tolerance in the dimensions of the plate, but do not provide for any tolerance in the punching. I think there should be some tolerance in size, at least, if not in location. It is important there should not be very great tolerance in location.

(The motion on the adoption of the specifications was carried.)

Chairman Wiltsee: The next item is the specifications for screw track spikes. I move the adoption of the specification.

(Motion seconded and carried.)

Chairman Wiltsee: The next item is the specifications for wrought iron tie plates. I move the adoption of this specification.

(The motion was seconded and carried.)

Chairman Wiltsee: The next item is the specifications for malleable iron tie plates. I move the adoption of this specification for publication in the Manual.

(Motion seconded and carried.)

Chairman Wiltsee: We refer to specifications for the design and dimensions of manganese steel pointed switches. These specifications were printed in Vol. 18 of the proceedings for 1917. I move the adoption of these specifications for publication in the Manual.

(The motion was seconded and carried.)

Chairman Wiltsee: The next item which we wish to present are the plans submitted for adoption by subcommittee 2. These were printed in a separate folder.

(He then in turn moved the adoption of plans 101 to 108 inclusive covering switches, plans 201 to 204 inclusive for switch fixtures, and plans 210 and 211 for switch material, and they were all accepted.)

Chairman Wiltsee: The next plans, 301, 302, 303, 304, 306 and 307 are for bolted rigid frogs. I move the adoption of these plans for publication in the Manual.

H. H. Harsh (B. & O.) In these plans for frogs the length of the arms are all the same, and I notice that in the plans prepared by the committee for typical layouts, which are being submitted at this convention as a matter of information, they suggest layouts which will require the use of rails in leading up, that vary from 2.5 to 3 in. shorter than the full length material we receive from the mills. Nearly all the rails we receive are even lengths, and the leading up plans show 32.9 and 32.10, etc., and I think it would be wise to modify the length of the arm of the frogs and use even foot rails in the leading up rails.

The President: That matter will be left in the hands of the committee.

(Mr. Wiltsee then offered plans 305 to 308 on rigid bolted frogs, plans 401, 402 and 403 for spring rail frogs, plans 501 and 502 for guard rails, plans 601 to 607 inclusive for rail bound manganese frogs and plans 651 to 655 inclusive for solid manganese steel frogs and they were all accepted.)

Chairman Wiltsee: The committee submits plans 331 to 334, inclusive, and 335, clamped frogs and details of plates for clamped frogs. I move that the matter be accepted as information.

A. H. Mulliken (Pettibone Mulliken Co.): I move as an amendment that plans 331 to 334, inclusive, and 335 be approved for publication in the Manual.

Mr. Baldridge: Inasmuch as we have adopted a dozen or 15 plans which perhaps only a half dozen members have seen, I do not see any reason why we should hesitate to adopt this. By vote of this convention last year, this committee was instructed to bring in plans this year for clamped frogs, and apparently very few of us saw what they brought in.

Mr. Mulliken: The clamp frogs were turned down by the committee by a vote of two. I think it is largely a matter of unfounded prejudice against the clamped frog. This particular type of clamp frog which is to be published for information has been in use for more than 30 years, and I see no reason why it should not be approved and published in the Manual.

Chairman Wiltsee: If you will let us take our time we will put this matter in shape.

C. W. F. Felt (Santa Fe). The clamped frog is used on the Santa Fe wherever we use a rigid frog, with the exception of manganese. I would like to ask whether the committee has this still under consideration?

Chairman Wiltsee: It has.

Fred Lavis (American Int. Corporation): As some of us were not closely in touch with actual practice on the railroads, have been in the habit for a long time of taking the Manual as a sort of bible, and I happen to be one of those, and I should very much dislike to see things go into the Manual which do not even have the approval of the committee.

The President: The chair would take the opportunity of saying that these plans will be received as information and will be published in the proceedings and will be available to all. The committee has acknowledged, as far as some of these plans are concerned, they are not complete.

Mr. Mulliken: This is simply putting into the Manual something that has been so thoroughly tested in the last 30 years. It seems unfortunate there should be any question about it at all. I do not see why it should not go

into the Manual, as an alternate, as so many other alternates go in, on frogs and switches and other standards.

Mr. Campbell: I would like to see this clamp frog go into the Manual along with the older frogs and such other frogs as the association may see proper to place there.

C. A. Morse (C. R. I. & P.): Mr. President, I have been familiar with clamp frogs for the last 20 years. The committee a year ago ignored the clamp frog entirely. They have been forced by the association to take it up, and they have had it in their hands for several months. We are going to get out a manual this coming year, and I think it should go in the Manual.

(Mr. Mulliken's amendment was put and defeated.)

Chairman Wiltsee: I submit the specification for relayer rails, and move that it be adopted and printed in the Manual.

(The motion was seconded and carried.)

Chairman Wiltsee: I offer the following resolution:

Whereas, the American Railway Engineering Association realizes the importance of the preparation of standards in frog and switch design; and

Whereas, the frog and switch manufacturers of the Manganese Track Society have co-operated heartily with the Track committee of this association to produce plans that will meet the requirements of the railroads and be in accordance with the best current mill practice; therefore be it

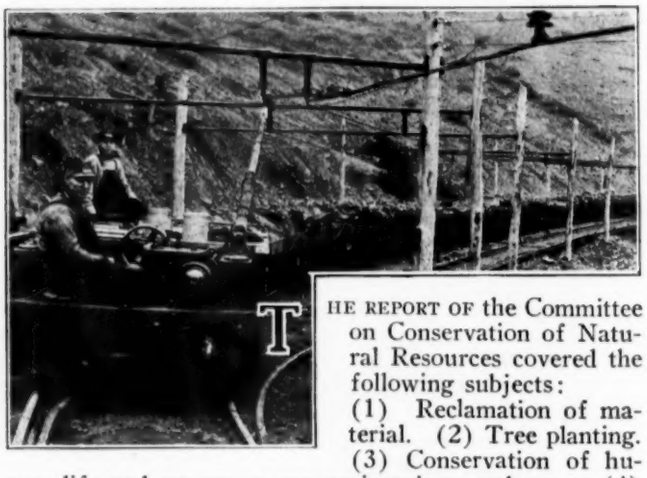
Resolved, That the members of the American Railway Engineering Association desire to show their appreciation of this co-operation and of the immense amount of work done by these manufacturers to accomplish this end, and hereby extend a vote of thanks to the members of this organization.

(The motion was carried.)

Victor Angerer (Wm. Wharton, Jr., & Co.): On behalf of the Manganese Track Society I want to thank the association for the vote, and to say that we appreciate it very much and are always glad to co-operate with you.

(The committee was discharged with the thanks of the association.)

# Report on Conservation of Natural Resources



THE REPORT OF the Committee on Conservation of Natural Resources covered the following subjects: (1) Reclamation of material. (2) Tree planting. (3) Conservation of human life and energy among engineering employees. (4) Rules for the prevention of the spread of forest and field fires. (5) Progress of conservation in Canada.

"Rules for the Prevention of the Spread of Forest and Field Fires" were formulated at the request of the United States Railroad Administration and have been approved by the American Railroad Association.*

### CONCLUSIONS

1. That the reports on reclamation of material, tree planting, conservation of human life and energy, and progress in conservation in Canada, be received as information.

2. That the "Rules for the Prevention of the Spread of Forest and Field Fires" be approved and published in the Manual.

Committee: R. C. Young (L. S. & I.), chairman; S. N. Williams, vice-chairman; R. H. Aishton (A. R. A.), W. K. Barnard, C. B. Brown (C. G. R.), Moses Burpee (C. N. R.), C. H. Fisk, E. E. King (U. of Ill.), William McNab (G. T.), W. F. Ogle (C. R. I. & P.), J. L. Pickles (D. W. & P.).

### Appendix A—Reclamation of Material

Many roads have taken up the subject of reclamation of material to such an extent as to erect shops equipped with special appliances for working over at small cost much of the worn and damaged material that formerly went into the scrap pile. They have found that rails with split and battered ends can be sawed into shorter lengths and used again on the main line; that worn and broken frogs and crossings, switch points and rail ends can be built up and welded, many of them in place, by means of the oxy-acetylene welding torch; that worn and bent angle bars, heated in an oil furnace, and placed in a die, can be swedged into their original sections by means of a drop-hammer. Some roads have found that oiling track bolts at regular intervals is an effective means for the conservation of labor and material.

Many roads are finding the sawmill a useful agency in the conservation of timber. Old stringers that formerly were used for platforms, runways, sidewalks, culverts, foundations, retaining walls and back walls in pile and frame trestle bridges can be sawed so as to recover a great deal of valuable lumber.

Much of the lumber that is being used for signs and crossings might be conserved by substituting other materials more permanent and in many cases no more expensive than wood. Public crossings could be made very satisfactorily out of reinforced concrete slabs or out of crushed stone or other ballast materials held in position by a bituminous binder.

Old buildings along the line that cannot serve any useful purpose in their present location or elsewhere should be torn down and all of the material reclaimed and used where they can be made to serve some useful purpose. In many cases the old ties removed from the track can be utilized. Pile-heads that in many cases were thrown away can now be made to serve a useful purpose. The elm and maple pile-heads can be sawed and turned into jack and cant-hook handles; oak pile-heads can be sawed into center and ballast stakes; while cedar pile-heads can be sawed into shingles.

### Appendix C—Conservation of Human Life and Energy

Conservation of health is one of the greatest subjects before the public to-day. To assist, health laws and regulations should be rigidly enforced on all citizens. Too much care cannot be taken in public or private about proper disposition of the sputum, as this is decidedly dangerous. Ventilation of both public and private buildings

*Published in the Railway Maintenance Engineer for January, 1920, page 30.

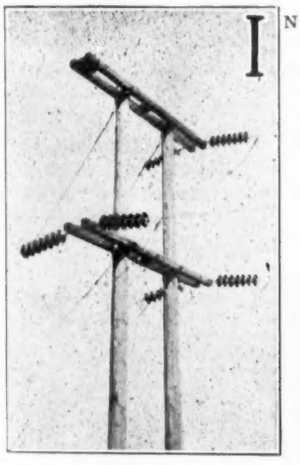
is of the utmost importance in prevention of tuberculosis and pneumonia. Sanitation consists of about 99 per cent cleanliness and 1 per cent science. Sunshine, sleep, fresh air, cleanliness, moderation in work, proper food, rest and exercise are nature's great panaceas; also good teeth, proper clothing, avoidance of all excesses or abuses, with prompt removal of all refuse.

The U. S. Commission of Labor Statistics finds that the average annual number of disability days for 40,000 wage earners in 42 occupations is 6.4 for all disability, but is 8.4 for railway employees, and 9.6 for freight handlers, increasing rapidly with age from 45 to 59, indicating necessity for special care in this class and ages, as also the necessity for limiting sickness to the minimum and prolonging life to the maximum by reducing the unnecessary death rate of modern times. About 20 per cent of all workers suffer from disabling sickness lasting more than seven days each year and 700,000, or nearly 25 per cent, of all workers are suffering from a disabling sickness every working day, while another one-half per cent are away from work each day on account of trivial disabilities. The losses to sick men are very serious and as 6,000,000 workers are annually disabled, a saving of merely 25 per cent of the loss would bulk large in the nation's wealth.

### Discussion

In the absence of the chairman the report was submitted by the vice-chairman, S. N. Williams, who discussed the work of the committee and its report at some length. His motion that the matter referred to in Conclusion 1 of the committee be accepted as information was carried, as was a second motion that the Rules for the prevention of the Spread of Forest and Field Fires be approved and published in the Manual.

# Report of the Committee on Electricity



IN APPENDIX A of its report the committee submitted revisions of the record tables, which had been brought up to date, regarding third rail clearances and overhead clearances.

In Appendix B of its report the committee submitted "Specifications for Electric Light, Power Supply and Trolley Lines Crossing Steam and Electric Railways," prepared by the Joint Committee appointed by the American Railroad Association, the American Electric Railway Engineering Association and our own Association, these specifications to supersede similar specifications now contained in the Manual.

In Appendix C the committee reported on the subject of Electrolysis and Its Effect on Reinforced Concrete, and its recommendations are given under the conclusions.

In Appendix D the committee reported on the subject of Water Power for Electric Railway Operation, and its recommendations are given under the conclusions.

In Appendix E the committee reported on the subject of Electrical Interference, and its recommendations are given under the conclusions.

In Appendix F of its report the committee reported the result of its work in collaboration with the United States Bureau of Standards in the revisions of the proposed National Electrical Safety Code.

### Conclusions

1. The committee recommended that no changes be made in the electrical definitions in the Manual.

2. The committee recommended that its Statements 1 and 2, giving revised Data for Third Rail and Overhead Clearances, be accepted as information and published in the Proceedings.

3. The committee recommended that the "Specifications for Electric Light, Power Supply and Trolley Lines Crossing Steam and Electric Railways," being Appendix B, be approved and printed in the Manual.

4. The committee recommended that the report on Electrolysis and Insulation, being Appendix C, be accepted as information, published in the Proceedings, the subject continued and the committee be authorized to continue its representation on the American Committee on Electrolysis.

5. The committee recommended that the subject of Maintenance Organization and Relation to Track Structures be continued.

6. The following general statements are made regarding the utilization of water power for the electric operation of steam railroads:

(1) That 110,000 volts transmission of electric power, with 3,000 volts on the trolley wire, are practical and reliable voltages for electric railroad service for 100 miles or more of single track.

(2) That such a system of electric operation will increase the capacity of a railroad from 25 to 35 per cent.

(3) That such a system of electrification will probably prove economical as compared with steam operation, when the cost of reliable electric power and coal bear the relation one to the other that they do in the table (Appendix D) as shown above the diagonal line, provided the railroad traffic is favorable for electric operation.

(4) The introduction of electric locomotives equipped with electric brakes has made possible the haulage of heavier trains at higher speeds on mountain divisions with greater safety and reliability, under all climatic conditions.

The committee recommended that the Report on Water Power, being Appendix D, be accepted as information, published in the Proceedings and the subject continued.

7. The committee recommended that the Report on Electrical Interference, being Appendix E, be accepted as information and the subject continued.

8. The committee recommended that the Report on National Safety Codes, being Appendix F, be accepted as information and that the committee be instructed to continue its co-operation with the United States Bureau of Standards.

Committee: Edwin B. Katte (N. Y. C.), chairman; D. J. Brumley (I. C.), vice-chairman; A. H. Armstrong (Gen. Elec.), H. M. Bassett (N. Y. C.), R. D. Coombs (Cons. Engr.), Walt Dennis (Wabash), R. H. Ford (C. R. I. & P.), G. W. Kittredge (N. Y. C.), J. G. Leisenring (Ill. Traction), C. E. Lindsay (U. S. R. A.), H. K. Lowry (C. R. I. & P.), W. L. Morse (N. Y. C.), J. R. Savage (L. I.), M. Schreiber (P. S. R. of N. J.), F. E. Wynne (Westinghouse Elec. & Mfg. Co.).

### Appendix C—Electrolysis and Insulation

This committee reported in 1918 in detail and its conclusion was that the disintegration of concrete may be laid at the door of electrolytic action to a certain extent,

but that it is possible to design concrete work and install it so as to reduce this disintegration to almost a negligible amount. Since the last report the committee has been in close touch with some investigations that are being carried on by Dr. Gellert Alleman at the laboratories at Swarthmore College, and from these investigations the committee would suggest consideration along the following lines:

(1) The use of copper-plated reinforcing bars. The copper on the outside of the bars forms an oxide that is insoluble in salt water and does not permit the formation of iron oxide. It should be noted that the formation of iron oxide increases the volume of the iron oxidized about 1.7 times and exerts a pressure that will rupture any concrete.

(2) The introduction of reinforcing bars made of a copper alloy. Here the oxide is formed similar to that on the plated bars, and the action is the same.

(3) Reinforcing bars may be surrounded with a rough enamel that is not only impervious to salt water or any moisture, but also forms such a non-conductor that it will eliminate any electrolytic trouble.

(4) In case of ordinary structures in salt water, such as bridge piers and foundations, it has been proposed to install a waterproofing structure around it; this waterproofing to consist of a plastic layer of material with petroleum asphalt as a basis, or some established waterproofing material free from electrolytes. The plastic casing should then be finally protected with another layer of concrete or masonry material.

## Appendix D—Water Power

In the preparation of the report on Water Power for the generation of electricity for the operation of trains, it was considered necessary to inspect an installation of importance and magnitude in actual service. The installation selected was that of the Chicago, Milwaukee & St. Paul, and that portion of its electrified division was inspected by the committee between Harlowtown and Deer Lodge. The electric power for this installation is obtained from the Montana Power Company, and several of its more important water power developments were inspected by the committee.

The Montana Power Company has developed and now owns 12 hydro-electric plants and four steam plants. It develops 29,000 hp. and has about 1,900 mi. of high-tension lines, with 75 sub-stations. From five of the more important hydro-electric plants, high-tension power lines, approximately 250 mi. in length, radiate to and connect with five sub-stations of the Chicago, Milwaukee & St. Paul.

To compute the actual cost of current delivered to the railroad sub-stations it is necessary to obtain the first cost of the installation in order to ascertain the fixed charges. It should be understood in the cost figures given below that it would hardly be possible to get the cost so low in an isolated railroad plant. Generally speaking, the first cost of the hydro-electric plants was approximately $100 per kw.

### Buildings and Apparatus

There are fourteen sub-stations on the 440 mi. of road comprising the present electric zone of the St. Paul. The power transformers in the sub-stations are three phase transformers, stepping the voltage of the 110,000-volt transmission down to 2,300 volts for the synchronous motors forming part of the motor generator sets. There is a three phase transformer for each motor generator unit.

The motor generator sets consist of three units, a synchronous motor in the middle directly connected to and driving two direct current generators, one on each side of the synchronous motor. Each generator is designed to give 1,500 volt direct current and the two generators are connected in series to give 3,000 volts for the trolley.

### Catenary Suspension for the Working Conductor

The messenger is ½ in. dia. galvanized high strength steel seven strand cable supported on bracket type of construction by means of a porcelain insulator mounted on a metal pin attached to the upper side of the bracket. In span construction the messenger is attached to the span wires, which are insulated from the poles. The working conductors are normally continuous from one sub-station to another. The positive conductors consist of one 500,000 cir. mils copper feeder cable, two 4/0 trolley wires and one ½-in. steel messenger cable above described. On heavy mountain grades, or about 15 per cent of the line, an additional 500,000 cir. mils or 700,000 cir. mils cable is used. The supplement feeder is tapped to the trolley wires at intervals of 1,000 ft.

The return circuit consists of 85 or 90-lb. track rails with joints bonded in the usual manner and an auxiliary 4/0 A.W.G. copper strand cable attached to the poles above the other wires and serving also as a ground wire.

### Locomotives

The electric locomotives for passenger and freight service in the electric zone are of identical design, except that the passenger locomotives are equipped with oil fired flash boilers, oil and water tanks, etc., for heating coaches and are geared for higher speed than the freight locomotives. The complete locomotive is composed of two half units, each unit consisting of a cab mounted on two driving trucks. The frame of one truck is extended and carries the center pin for the guiding truck and the draft rigging.

C. M. & ST. P. RY.—ELECTRIC LOCOMOTIVES

| Type | Passenger | Freight | Switching |
|---|---|---|---|
| Classification | 444444 | 444444 | 404 |
| Total weight | 602,000 | 576,000 | 143,000 |
| Weight mechanical equipment | 354,000 | 328,000 | 85,000 |
| Weight electrical equipment | 248,000 | 248,000 | 57,500 |
| Weight on guiding wheels | ..... | ..... | ..... |
| Weight on drivers | 475,500 | 450,000 | 143,000 |
| Tractive effort for starting | 136,000 | 136,000 | 42,000 |
| Tractive effort, 1 hr. rating | 45,200 | 85,000 | 18,400 |
| Tractive effort, continuous | 38,000 | 71,000 | 13,500 |
| Miles per hour, 1 hr. rating | 28.5 | 15.25 | 12.0 |
| Miles per hour, continuous rating | 29.6 | 15.75 | 13.2 |
| No. of motors | 8 | 8 | 4 |
| Type of motors | GE–253–A | GE–253–A | GE–255 |
| Voltage | 1500/3000 | 1500/3000 | 1500/3000 |
| Gearing | 82/18 | 71/29 | 64/17 |
| Length over all | 112′ 0″ | 112′ 0″ | 41′ 5″ |
| Total wheel base | 102′ 8″ | 102′ 8″ | 30′ 4″ |
| Rigid wheel base | 10′ 6″ | 10′ 6″ | 8′ 0″ |
| Diameter of guiding wheels | 36″ | 36″ | ..... |
| Diameter of drivers | 52″ | 52″ | 40″ |

There were furnished for this electrification of 440 mi. between Harlowtown and Avery, 30 electric freight locomotives, 12 electric passenger locomotives and two electric switches. Two more electric switchers of the same design as originally furnished have recently been delivered.

### Signal System

A complete description of this signal system will be found in the Railway Signal Engineer of September, 1917, page 256.

There has been no marked interference in the talking system by the propulsion system. The engineers of the A. T. & T. Company have made some study on the ground and found slight interference from so-called tooth-ripples of some thirteen hundred cycles.

No particular changes were necessary on account of the introduction of electrification in the arrangement of buildings or tracks, but the fact that two electric locomotives could handle a 2,800-ton train necessitated the lengthening of all the passing tracks to 1,000 ft. each.

### New Duties of the Train Dispatcher

In order to obtain a favorable contract for electric power the maximum demand for power must be kept as

low as it is practical to make it. For this reason a power indicating and limiting equipment is required for the purpose of indicating to the dispatcher the amount of power taken, and also for limiting the power to a predetermined amount. By the aid of this equipment the dispatcher regulates the dispatching of trains so as to avoid exceeding the predetermined amount of power agreed upon by the railway company and the power company. That is, the dispatcher sees to it that trains are not dispatched in a way that two or more trains are ascending the heavy grades at the same time, but will endeavor to dispatch them in a manner that permits one train to ascend the heavy grades while another is going down. Thus it becomes the duty of the train dispatcher to keep in mind not only the train movements, but also to regulate movements so that the power costs and overtime of crews will be a minimum. With a little study of train operations and a little practice the dispatchers are able to adjust the train movements to the needs of the service.

## Capital Cost

The table below gives a condensed grouping of items which are included in the capital cost of the electrification:

*Items Included in Capital Cost of Electrification*

440 miles first track electrification on wood poles.
147 miles other tracks, passing sidings, yards and spurs.
587 miles track bonding.
371 miles single conductor in three phase 100,000 volt transmission line.
14 sub-stations aggregate capacity 59,500 kw.
Engineering, signals, miscellaneous, etc.
Total (approximately) ..... $7,250,000
12—300-ton electric passenger locomotives.
30—288-ton electric freight locomotives.
*3— 70-ton electric switching locomotives.
*45 Total electric locomotives (approximately) ... $5,500,000
Less value of steam equipment replaced (est.) 2,500,000

Additional capital cost, account electrification ..... $10,250,000

The above capital cost covers a plant which is handling a greater tonnage than was previously handled by steam locomotives and the indications are that there is margin in the equipment supplied to handle a still greater tonnage.

The value of steam equipment replaced represents approximately the cost of 112 steam locomotives which were assigned to the Rocky Mountain and Missoula divisions prior to electrification taken at 9 cents per lb. (wt. of engine). This is hardly a fair comparison between steam and electric for the reason an additional investment would have had to be made in any event, in order to handle the increase in tonnage since electrification was begun. To attempt a comparison on this basis and estimate the additional equipment and track facilities required for steam operation would necessitate a very careful study of previous steam operation.

## Comparative Operating Results

B. Beeuwkes, electrical engineer of the Chicago, Milwaukee & St. Paul, in his paper before the New York Railroad Club, March, 1917,† compares three months' steam operation with three months' electric operation before the power limiting and indicating device was installed. Tables given in this paper showed that for the same tonnage hauled over the Rocky Mountain division, electric operation has effected a reduction of 22.5 per cent in the number of trains, 24.5 per cent in the average time per train and has improved operating conditions so that nearly 30 per cent more tonnage can be handled by electric operation in about 80 per cent of the time it formerly took to handle the lesser tonnage by steam operation. This means a valuable increase in the single track capacity of the line.

As a result of changed conditions any comparison of present electric operating costs with steam prior to January 1, 1917, is subject to considerable corrections to bring the steam expense to the same basis of costs as the electric. It is possible, however, to obtain from the annual operating statements certain operating costs which in many cases may serve as a guide in forecasting what economies may be obtained by the substitution of electric operation for steam. For this purpose the following table was compiled:

ELECTRICAL OPERATING COSTS

| | 1917 12 Months | 1918 12 Months | Averages Per Year 1917 and 1918 |
|---|---|---|---|
| Maintenance of Way and Structures— | | | |
| Power Substation buildings | $ 468.64 | $ 622.38 | $39.00 per substation. |
| Power transmission systems | 1,000.68 | 4,265.44 | $7.10 per mi. trans. line. |
| Power distribution systems | 81,944.74 | 73,277.70 | $134.00 per mi. track. |
| Power lines, poles and fixtures | 14,572.92 | 20,810.72 | $40.20 per route mi. (440). |
| Maintenance of Equipment— | | | |
| Power Substation Apparatus | $ 10,034.37 | $ 25,914.23 | $1,284. per substation. |
| Other locomotive repairs | 220,525.76 | 236,906.35 | 0.1023 per loco. mile. |
| Other locomotive depreciation | 77,134.23 | 85,208.51 | 0.0363 per loco. mile. |
| Transportation— | | | |
| *Yard switching power produced | $ 233.83 | ..... | ..... |
| *Train power produced | 49,402.15 | $ 94,580.46 | $5,151. per substation. |
| Yard switching power purchased | 8,321.86 | 12,230.88 | ..... |
| Train power purchased | 544,224.25 | 683.997.96 | ..... |
| Yard motormen | $ 16,007.63 | $ 23,084.87 | ..... |
| Train motormen | 262,177.75 | 346,260.32 | ..... |

*Sum of these two items represents mainly substation attendance.

The consensus of opinion of the roadmasters and superintendents on the electrified zone is that there is no more slipping of the locomotive wheels on the rail and consequently no more damage to the top of the rail under electric operation than there is with steam locomotives. It has not been found that there is any greater tendency for the rails to creep on account of regenerative braking on descending grades than there was under the braking

*Ratio Electric Power Expense to Fuel Expense for Various Prices of Coal and Electric Power Based on 1 Kwh Substation Input being Equivalent to 7 Pounds Coal on Tender of Steam Locomotives*

| Price of Coal 2000 lb | Price of Power Cents per Kwh | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | .525 | .700 | .875 | 1.050 | 1.225 | 1.400 | 1.575 | 1.750 | 1.925 | 2.100 | 2.275 | 2.450 | 2.625 | 2.800 | 2.975 |
| $8.50 | 176 | 235 | 294 | 353 | 412 | 471 | 529 | 588 | 647 | 706 | 765 | 824 | 882 | 941 | |
| 8.00 | 188 | 250 | 313 | 375 | 438 | 500 | 563 | 625 | 688 | 750 | 813 | 875 | 938 | | 1.063 |
| 7.50 | 200 | 267 | 333 | 400 | 467 | 533 | 600 | 667 | 733 | 800 | 867 | 933 | | 1.067 | 1.133 |
| 7.00 | 214 | 286 | 357 | 429 | 500 | 571 | 643 | 714 | 786 | 857 | 929 | | 1.071 | 1.141 | 1.214 |
| 6.50 | 231 | 308 | 385 | 462 | 538 | 615 | 692 | 769 | 846 | 923 | | 1.077 | 1.154 | 1.231 | 1.308 |
| 6.00 | 250 | 333 | 417 | 500 | 583 | 667 | 750 | 833 | 917 | | 1.083 | 1.167 | 1.250 | 1.333 | 1.417 |
| 5.50 | 273 | 364 | 455 | 546 | 636 | 727 | 818 | 909 | | 1.092 | 1.182 | 1.273 | 1.364 | 1.455 | 1.545 |
| 5.00 | 300 | 400 | 500 | 600 | 700 | 800 | 900 | | 1.100 | 1.200 | 1.300 | 1.400 | 1.500 | 1.600 | 1.700 |
| 4.50 | 333 | 444 | 556 | 667 | 778 | 889 | | 1.111 | 1.222 | 1.333 | 1.444 | 1.556 | 1.667 | 1.778 | 1.889 |
| 4.00 | 375 | 500 | 625 | 750 | 875 | | 1.125 | 1.250 | 1.375 | 1.500 | 1.625 | 1.750 | 1.875 | 2.000 | 2.125 |
| 3.50 | 429 | 571 | 714 | 857 | | 1.143 | 1.286 | 1.429 | 1.571 | 1.713 | 1.857 | 2.000 | 2.143 | 2.286 | 2.429 |
| 3.00 | 500 | 667 | 833 | | 1.167 | 1.333 | 1.500 | 1.667 | 1.867 | 2.009 | 2.167 | 2.333 | 2.500 | 2.667 | 2.833 |
| 2.50 | 600 | 800 | | 1.200 | 1.400 | 1.600 | 1.800 | 2.000 | 2.200 | 2.400 | 2.600 | 2.800 | 3.000 | 3.200 | 3.400 |
| 2.00 | 750 | | 1.250 | 1.500 | 1.750 | 2.000 | 2.250 | 2.500 | 2.750 | 3.000 | 3.250 | 3.500 | 3.750 | 4.000 | 4.250 |
| 1.50 | | 1.333 | 1.667 | 2.000 | 2.333 | 2.667 | 3.000 | 3.333 | 3.667 | 4.000 | 4.333 | 4.667 | 5.000 | 5.333 | 5.667 |

Note Diagonal Line indicates for what Prices of Coal and Electric Power the Expense is Identical

**Table for Comparing Steam and Electric Power**

action of steam locomotives. No case has been found where electric locomotives moving at a high rate of speed have tended to displace the rail on the ties or the ties in the ballast. Roadmasters agree that the electric locomotive is easier on the track than steam locomotives because of the less rigid construction. It is stated that the flange wear on curves under electric operation is actually less than under steam operation for the reason that the elec-

*Includes one 50-ton, 1500-volt locomotive at Great Falls not part of main line electrification.
†Abstracted in the *Railway Age Gazette* for March 23, 1917, page 642.

tric locomotives are less rigid in their wheel arrangement than the steam locomotive. On curves the outer rails are elevated for 30 m.p.h. on mountain grades and for 45 m.p.h. for valley territories. On the Rocky Mountain and Missoula divisions the mountain grade superelevation is ½ in. to one degree of curvature with a maximum of 3 in. On other curves the superelevation is 1 in. per degree with a maximum of 3½ in.

### Relation of Electric Power Consumption to Coal Consumed

From figures obtained from Mr. Beeuwkes' paper, the results indicate that one kw. hr. measured at the low tension side of the transformers in the sub-stations is equivalent to seven pounds of coal on the tender of a steam locomotive.

On the basis of the above relationship the ratios of power expense to coal expense for various prices of power and coal have been computed and are given in the table.

### Discussion

Edwin B. Katte (chairman) summarized the instructions to the committee, and moved that the Specifications for Electric Light, Power Supply and Trolley Lines Crossing Steam and Electric Railways, be approved and printed in the Manual.

(The motion was seconded.)

F. B. Hall (B. & M.): My understanding in readiny that specification is, that there has been a very material increase in the requirements, amounting to substantially 50 per cent over the old specifications. It seems to me in one or two cases that the construction required under these new specifications will be difficult with material of ordinary construction. For example, the working load allowed on a 0000 wire, I believe is about 5,000 pounds. The new specification requires a factor of safety of 3. I would like to have the committee explain just how that specification could be applied.

The Chairman: You will note that these are specifications for electric light, power, supply and trolley line crossings. With regard to the factor of safety, the committee referred all the factors of safety to the structural engineers, and also to the committee on steel and iron structures. The factors of safety are somewhat higher than required by the Bureau of Standards, but no higher than usually required in railroad structures.

Mr. Hall: I have not made my point clear in regard to the 0000 wire. I haven't in mind any construction which will permit of a greater strength than about 9,000 lb. If a factor of safety of 3 is required, a disc insulator must be found which will support 15,000 lb.

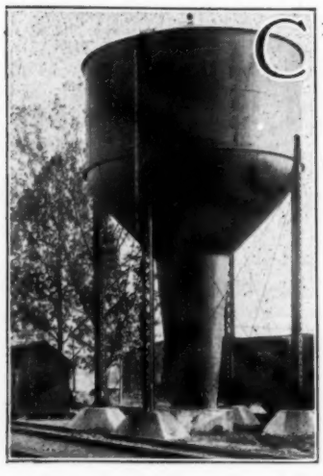
The Chairman: I can only explain that at the time this was being considered we had several insulator manufacturers in with us, and they sat in the committee meeting and agreed that the specification as written was entirely permissible and satisfactory to the disc insulator or standard insulator manufacturers.

(The question was put and carried.)

The chairman then summarized the balance of the report, and recommended its adoption as a whole.

(The motion was carried and the committee was excused with thanks.)

# Report of Committee on Water Service



CHANGES IN THE 1915 edition of the Manual are suggested under the head of conclusions below.

A progress report on the supply of drinking water on trains and premises of railroads appears in Appendix "B," in the form of an item for insertion in the Manual. A final report on water service organization is submitted in Appendix "C" for adoption and publication in the Manual.

A final report on impounding reservoirs and conditions under which they are economical is submitted in Appendix "D" for adoption and publication in the Manual.

A final report on meters for railroad water service is submitted in Appendix "E" for adoption and publication in the Manual.

A list of terms common to use in railroad water service was submitted in Appendix "F" of the committee's report with definitions for publication in the Manual.

A progress report on plans and specifications for typical water station layouts was submitted in Appendix "G."

Tentative specifications for wooden water tanks of 50,000 and 100,000 gal. capacity were submitted in Appendix "H."

### Conclusions

The committee requested the following action on its report:

(1) It is suggested that all subject matter on pages 446, 447 and 448 in the 1915 Manual and also the 10th and 11th lines from the bottom of page 445 be eliminated, as the information is not generally applicable to present types of softening plants and should be considered rather as reference matter in the proceedings.

It is suggested that page 463, Typical Layout for Surface Pipe Wells, be omitted as proposing a rather detailed plan which is not of general application.

(2) That the three paragraphs containing general statements of facts on regulations affecting drinking water furnished by railroads be adopted for insertion in the Manual.

(3) That the final report on "Water Service Organization" be adopted for publication in the Manual.

(4) That the final report on "Impounding Reservoirs" be adopted and inserted in the Manual.

(5) That the report on "Water Meters for Railroad Use" be adopted for publication in the Manual.

(6) That list of definitions for railroad water service terms be adopted and included in water service section of the Manual.

Committee: A. F. Dorley (M. P.), chairman; J. L. Campbell (E. P. & S. W.), vice-chairman; R. C. Bardwell (M. P.), J. M. Brown (C. R. I. & P.), E. M. Grime (N. P.), W. C. Harvey (C. G. W.), R. L. Holmes (T. & P.), H. H. Johntz (M. K. & T.), C. R. Knowles (I. C.), E. G. Lane (B. & O.), Thomas Lees (C. P. R.), W. M. Neptune (M. P.), E. H. Olson (A. T. & S. F.), W. A. Parker (U. P.), A. B. Pierce (Sou.), C. P. Richardson (C. R. I. & P.).

### Appendix B—Regulations of Federal or State Authorities Relating to Supply of Drinking Water on Trains and Premises of Railroads

The following three paragraphs are recommened for insertion in the Manual as subject matter under Railroad Water Service:

1. Federal Interstate Quarantine Regulations, Section 13 to Amendment No. 8, as amended July 14, 1919, and issued by the Public Health Service, provide that water for drinking purposes furnished by railroads on cars in interstate traffic shall be pure and incapable of conveying disease, and shall be from source not exposed to possible contamination.

2. It is preferable, where available at reasonable cost, that drinking water furnished by railroads should be secured from municipal supplies, as these, as a rule, secure close supervision from local and state health authorities.

3. Where impossible or impracticable to secure potable water from municipal source, precautions should be taken to provide against possible contamination. If supply is secured from wells, local drainage conditions should receive consideration and protection provided against this entering the wells. Surface supplies are particularly susceptible to contamination, and when used should receive standard treatment with bacteriacides such as calcium hypochlorite, chlorine, or ultra violet ray. All such supplies should be tested regularly and if found unfit should be posted with warning—"UNFIT TO DRINK."

## Appendix C—Water Service Organization

The superintendent or engineer of water service shall have direct charge of chemist, inspectors and construction forces, and acts in an advisory capacity to the division forces. A monthly report of the operation of water stations, form MW 1302, shall be forwarded to the superintendent or engineer of water service, together with all other reports relating to water facilities.

The chemist shall report to the superintendent or engineer water service, and shall have supervision of water treatment and the analysis and examination of water.

The inspector shall periodically inspect water stations, reporting to the superintendent or engineer water service on proper form the conditions in detail and the repairs and renewals required, together with the estimated cost.

The supervisor water service shall report to the division maintenance office, and shall have charge of gang foremen, repairmen and pumpers.

The construction foreman shall report to the superintendent or engineer water service and shall have charge of construction forces and perform such other work as may be assigned to him.

## Appendix D—Impounding Reservoirs for Railroad Purposes

*Introduction.*—The most desirable site is one from which water can be delivered by gravity or involves the least pumping head. The impounding area should be sufficient to maintain an adequate supply throughout the longest dry period, which may extend over two consecutive years. Impounding reservoirs are justified at places where the cost of water delivered does not exceed that of other equally usable dependable supply. Reservoirs should be located where the topographic and climatic conditions are most favorable.

*Drainage Area.*—This should be favorable to a considerable surface runoff. An excessive area increases amount of silt and size of spillway. The ratio of drainage area to spillway contour should be not less than 35 or 40, and the reservoir should have a water depth approximating 25 feet.

*Water Requirements.*—The maximum demands for present or the near future use should be determined. The growth of traffic should be studied for a guide in forecasting the probable ultimate needs.

*Land Evaporation.*—This is principally influenced by temperature and wind and usually varies from about one-fourth to two-thirds of the yearly rainfall.

*Transpiration.*—This is mainly influenced by temperature and moisture and generally varies from 4 to 10 in. during the growing season for areas having mixed vegetation, the water requirements for plants varying from 300 to 1,000 times the weight of the dry matter produced.

*Interception.*—This is the portion of the precipitation intercepted and evaporated without reaching the ground, and is in a measure constant for each rain and probably amounts to 0.10 in. per rain, or something like 15 to 40 per cent of the annual precipitation.

*Runoff—Surface and Sub-Surface.*—This is the residual precipitation after land evaporation, transpiration, interception and deep seepage losses have been deducted, and varies generally from 5 to 50 per cent of the annual precipitation.

*Method of Determining Runoff.*—All rainfall records near site and in storm path should be carefully studied and platted, likewise the daily rainfall, temperature, wind and humidity records for the period for which the calculations are made. Runoff computations should be made for the year preceding a drought for the duration of the dry period, while the computations for the spillway should be based on the heaviest precipitations.

*Water Evaporation.*—This depends chiefly on temperature, but is largely influenced by the wind and humidity. In the more arid regions evaporation from reservoir surface is the greatest loss.

## Appendix E—Water Meters

### Reading Meters

1. The straight reading indicator consists of revolving discs with figures around their periphery revolving on a common shaft, the figures denoting the meter reading are exposed through a slot in the dial face. The standard indicator consists of a train of clock gears and pinions, with points indicating on numbered circles or indices the figures which form the meter reading. The standard indicator is in almost general use, as it is much simpler in mechanism and is less liable to get out of order than the straight reading indicator.

### Testing Meters

The correct method of testing water meters is by weighing the water, and this method should be followed whenever possible. To determine the percentage of error in registration, multiply the error in pounds per cubic foot by 16 and divide by 10. It is necessary to run at least one complete revolution of the hand of the first indice of the meter dial in all tests as the graduations of the indice may not be exact.

When necessary to make several runs to complete one revolution of the first indice, the total weight of water delivered in the several runs should be added, and in no case should a sub-division of the circle be used to calculate the accuracy of the meter. When testing a meter, a valve should be placed on the outlet side of the meter and a pressure maintained, making the conditions of test similar to that of actual service. When the test by weight is impractical meters may be tested in place by using a hose or pipe from the outlet of meter to a test meter of known accuracy.

### Maintenance of Meters

The maintenance of water meters is largely a matter of inspection, testing and cleaning. The total cost of repair parts usually represents but a very small proportion of the expense of maintaining meters. Where water is furnished through a meter, the meter is generally maintained by the parties furnishing the water, regardless of ownership of meter. Whenever practical a railroad

should standardize its water meters, as this enables employees to so familiarize and perfect themselves in the knowledge of the mechanical construction as to maintain a system of meters at least expense and greatest efficiency.

### Hot Water Meters

A hot water meter is similar in construction to a cold water meter except that bronze or similar metal is used for discs, etc., instead of vulcanized rubber, as the hard rubber used in cold water meters becomes pliable at about 120 deg. F. A hot water meter should not be used in continuous service for either hot or cold water, as the metal working parts wear much more rapidly than in the cold water meter where dissimilar substances come in contact.

### Types of Meters Suitable for Railway Service

While all types of meters are used successfully in railway water service, their use may be well confined to two types for general service, namely, the disc and current type of meter. The disc type of meter is very satisfactory in the smaller sizes and for fairly uniform flow up to three inches. The area of the disc is so great in the larger sizes that they are easily damaged through water hammer; therefore, a current meter should be used for services larger than three inches.

The current or velocity type of meter is designed for the rapid delivery of a large quantity of water, and is a very durable type of meter under heavy duty. The water areas are large as compared to the wearing surfaces and the wear is not as great as with other types of meters even when handling muddy or gritty water.

### Discussion

The President: In the absence of Mr. Dorley (chairman), J. L. Campbell (vice-chairman) will present the report.

J. L. Campbell (E. P. & S. W.): In submitting this report the committee will have a number of changes to propose in the matter contained in the report as printed. Taking up the first subject, revision of the Manual, it is suggested that subject matter noted above under Conclusions (1) be eliminated from the Manual. The committee moves the elimination of this matter in the reprint of the Manual. (Motion carried.)

Mr. Campbell: Referring to the "Supply of Drinking Water on Trains and Premises of Railroads," the committee proposes that in the last two lines of No. 1, under Appendix B, the words "and incapable of conveying disease," and the words "exposed to possible contamination," be eliminated, and that this section read as follows: "Federal Interstate Quarantine Regulations, Sec. 13 to Amendment No. 8, as amended July 14, 1919, and issued by the Public Health Service, provided that water for drinking purposes furnished by railroads on cars in interstate traffic shall be pure and from a source which is approved as producing a water of satisfactory sanitary quality and safety."

The committee moves that sections 1, 2 and 3, Appendix B, as read, be adopted for publication in the Manual. (Motion carried.)

Mr. Campbell: The committee moves that the water service organization as appearing above be adopted for publication in the Manual.

C. F. Ford (R. I.): Do I understand the committee to advocate that as an ironclad organization or a suggested form of organization?

Mr. Campbell: It is the intention of the committee that this simply be in the form of a recommended organization suggested to you for inclusion in the Manual.

The President: Does this suggested layout exist on any railroads at the present time?

C. R. Knowles (I. C.): The chart as submitted represents an organization as existing on a number of roads, or rather a combination of several organizations—this organization would necessarily have to be modified to suit the conditions for a larger or smaller road.

(The motion was seconded and carried.)

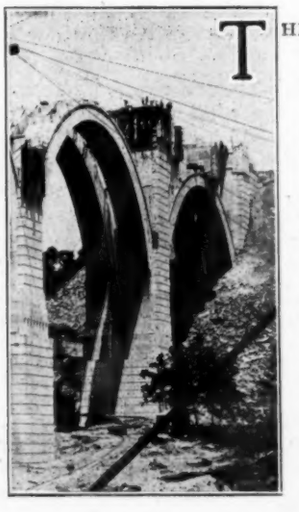
Mr. Campbell. The committee moves that Section 4 and Appendix D be adopted for publication in the Manual. (Motion seconded and carried.)

Mr. Campbell then presented Section 5 and Appendix E, and moved that this part of the report be adopted for publication in the Manual. (The motion was seconded and carried.)

Mr. Campbell then presented Sec. No. 8, specifications for wood water tanks, in Appendix H of its report, which, after considerable discussion, were accepted for inclusion in the Manual.

(The committee was dismissed with thanks.)

# Report of Committee on Masonry



The committee recommended the following action be taken on its report:

1. That certain revision of the Manual as to definitions be approved.
2. That the "Specifications for Plain and Reinforced Concrete and Steel Reinforcement" be withdrawn from the Manual, and the "Specifications for Concrete, Plain and Reinforced," given in Appendix B, substituted.
3. That the "Specifications for Billet-Steel Concrete Reinforcement Bars," given in Appendix B, be adopted and published in the Manual.
4. That the matter headed "Methods of Depositing Concrete Under Water" be withdrawn from the Manual and the recommendations given in Appendix C under a similar heading substituted.

Committee: J. J. Yates (C. R. R. of N. J.), chairman; Job Tuthill (P. M.), vice-chairman; J. T. Andrews (B. & O.), R. Armour (G. T.), G. E. Boyd (D. L. & W.), T. L. Condron (Cons. Engr.), L. N. Edwards (Bur. of Pub. Roads), W. K. Hatt (Purdue Univ.), L. J. Hotchkiss (Foundation Co.), Richard L. Humphrey (Cons. Engr.), Noah Johnson (Wabash), M. S. Ketchum (Univ. of Penn.), W. M. Kinney (Port. Cem. Asso.), W. S. Lacher (*Railway Age*), A. E. Owen (C. R. R. of N. J.), W. M. Ray (B. & O.), F. E. Schall (L. V.), Z. H. Sikes (N. Y. C.), C. C. Westfall (I. C.).

## Appendix B—Specifications for Concrete—Plain and Reinforced

### Materials

**Cement.**—1. The cement shall meet the requirements of the American Railway Engineering Association's "Specifications for Portland Cement." It shall be stored in a weather-tight structure with the floor raised not less than one foot from the ground in such manner as to permit easy access for proper inspection and identification of each shipment. Cement that has hardened or partially set shall not be used.

**Fine Aggregate.**—2. (a) The fine aggregate shall consist of sand, crushed stone or gravel screenings, graded from fine to coarse, and passing when dry, a screen having holes ¼ in. in diameter. Not more than 25 per cent by weight shall pass a No. 50 sieve, and not more than 6 per cent a No. 100 sieve when screened dry, nor more than 10 per

cent dry weight shall pass a No. 100 sieve when washed on the sieve with a stream of water. It shall be clean and free from soft particles, mica, lumps of clay, loam or organic matter.

(b) The fine aggregate shall be of such quality that mortar briquettes made of one part of Portland Cement and three parts of the fine aggregate by weight shall show a tensile strength, after an age of seven days, not less than the strength of briquettes of the same age, made of mortar of the same consistency in the proportion of one part of the same cement to three parts of standard Ottawa Sand.

**Coarse Aggregate.**—3. The coarse aggregate shall consist of gravel or crushed stone, which, unless otherwise specified or called for on the plans, shall, for plain mass concrete, pass a screen having holes 2¼ in. in diameter, and for reinforced concrete a screen having holes 1¼ in. in diameter; and be retained on a screen having holes ¼ in. diameter, and shall be graded in size from the smallest to the largest particles. It shall be clean, hard, durable and free from all deleterious matter; coarse aggregate containing dust, soft or elongated particles shall not be used.

**Stone for Rubble or Cyclopean Concrete.**—4. These stones shall be of good quality, clean, dense and hard, without seams and having sharp edges. They shall not be smaller than of a size known as "one man stone."

**Slag.**—5. Provided the contract specifically permits the use of crushed slag as a coarse aggregate, it shall be air cooled, blast furnace slag, conforming to all the requirements for coarse aggregate specified in Paragraph 3. The crushed slag shall weigh not less than 70 lb. per cu. ft., and shall be obtained only from such banks as have the approval of the engineer. All slag used shall have seasoned in the bank for a period not less than one year, unless in the opinion of the engineer a shorter period is sufficient.

**Water.**—6. The water shall be free from oil, acid and injurious amounts of vegetable matter, alkalies or other salts.

**Steel Reinforcement.**—7. (a) All structural steel shapes used for reinforcing shall conform to the requirements of the American Railway Engineering Association's "Specifications for Steel Railroad Bridges."

(b) All steel rods or bars used for reinforcing shall conform to the requirements of the American Railway Engineering Association's "Specifications for Billet-Steel Concrete Reinforcement Bars."

### Proportioning

**Unit of Measure.**—8. The unit of measure shall be the cubic foot. Ninety-four pounds (one sack or one-fourth barrel) of cement shall be assumed as one cubic foot.

**Proportions.**—9. (a) The proportions of the materials shall be in accordance with the plans, or detailed specifications, or schedule governing the work. When not otherwise specified, the proportions by volume shall be as follows: (See 8, 10.)

| Class. | Use. | Cement. | Fine Aggregate. | Coarse Aggregate. |
|---|---|---|---|---|
| A | Reinforced concrete—Concrete deposited under water ..... | 1 | 2 | 4 |
| B | Mass concrete in forms. | 1 | 2½ | 5 |
| C | Foundation ..... | 1 | 3 | 6 |

(b) Rubble or cyclopean concrete, when permitted by the contract, shall be either Class "B" or Class "C" concrete, having embedded in it large stones.

(c) For any given class of concrete, the relative proportion of cement to fine aggregate shall not be modified. The relative proportion of fine to coarse aggregate shall be modified, if necessary, during the progress of the work, so as to obtain the maximum density. (See 9a.)

**Measuring Proportions.**—10. The various ingredients, including the water, shall be measured separately, and the methods of measurement shall be such as to invariably secure the proper proportions. The fine and coarse aggregate shall be measured loosely as thrown into the measuring receptacle. (See 8, 9a.)

**Consistency.**—11. The quantity of water used in mixing shall be the least amount that will produce a plastic or workable mixture which can be worked into the forms and around the reinforcement. Under no circumstances shall the consistency of the concrete be such as to permit a separation of the coarse aggregate from the mortar in handling. An excess of water will not be permitted, as it seriously affects the strength of the concrete, and any batch containing such an excess will be rejected.

**Premixed Aggregate.**—12. (a) Provided the contract specifically permits, premixed aggregate may be used instead of separate fine and coarse aggregates. Frequent tests shall be made to determine the relative proportions of fine and coarse aggregates, and if these proportions are unsatisfactory to the engineer, or so irregular as to make it impracticable to secure a properly proportioned concrete, he may reject the material, or require that it be screened and used as separate fine and coarse aggregates.

(b) The proportion of the cement to the fine aggregate shall at no time be less than that specified for the classes of concrete where separate aggregates are used. (See 9a.)

### Forms

**Materials.**—13. (a) The forms shall be of wood or metal, and shall conform to the shape, lines and dimensions of the concrete as called for on the plans. Form lumber used against the concrete shall be dressed on one side and both edges, to a uniform thickness and width, and shall be sound and free of loose knots.

(b) For all exposed edges, corners or other projections of the concrete, suitable moldings or bevels shall be placed in the angles of the forms to round or bevel the edges of the concrete.

**Workmanship.**—14. (a) The forms shall be well built, substantial and unyielding, and made sufficiently tight to prevent leakage of mortar and voids in the concrete. They shall be properly braced or tied together by rods, bolts or wires. Metal braces or ties shall be so arranged that when the forms are removed, no metal shall be within one inch of the face of the finished work.

(b) The face forms shall be securely fastened to the studding or uprights in horizontal lines.

(c) Any irregularities in the forms which may mar the exposed surface of the concrete shall be removed or filled.

**Inspection.**—15. Where necessary, temporary openings shall be provided at the base of the forms to facilitate cleaning and inspection directly before placing concrete. (See 23b.)

**Oiling.**—16. The inside of the forms shall generally be coated with raw paraffin or other non-staining mineral oil; or thoroughly wet with water, except in freezing weather. (See 23b.)

**Removal of Forms.**—17. The forms shall not be removed until authorized by the engineer.

### Reinforcement

**Placing Reinforcement.**—18. Reinforcement steel shall be cleaned of all mill and rust scales before being placed in the forms. All reinforcement shall be placed in its proper position as required by the plans and securely wired or fastened in place, well in advance of the concreting, and shall be inspected and approved by the engineer before any concrete is deposited. (See 23b.)

**Splicing Reinforcement.**—19. Wherever it is necessary to splice the reinforcement otherwise than as shown on the plans, the character of the splice shall be decided by the engineer on the basis of safe bond stress and the stress in the reinforcement at the point of splice. Splices shall not be made at points of maximum stress.

### Mixing

**Machine Mixing.**—20. (a) All concrete shall be mixed by machine (except when under special conditions the engineer permits otherwise), in a batch mixer of an approved type, equipped with suitable charging hopper, water storage and a water measuring device which can be locked.

(b) The ingredients of the concrete shall be mixed to the required consistency and the mixing continued not less than 1½ min. after all the materials are in the mixer, and before any part of the batch is discharged. The mixer shall be completely emptied before receiving materials for the succeeding batch. The volume of the mixed material used per batch shall not exceed the manufacturers' rated capacity of the drum. (See 11.)

**Hand Mixing.**—21. When it is permitted to mix by hand, the mixing shall be done on a watertight platform of sufficient size to accommodate men and materials for the progressive and rapid mixing of at least two batches of concrete at the same time. The batches shall not exceed ½ cu. yd. each. The materials shall be mixed dry until the mixture is of a uniform color, the required amount of water added, and the mixture continued until the batch is of a uniform consistency and character throughout. Hand mixing will not be permitted for concrete deposited under water. (See 11.)

**Retempering.**—22. The retempering of mortar or concrete which has partially hardened; that is, remixing with or without additional materials or water, will not be permitted.

### Depositing

**General.**—23. (a) Before beginning a run of concrete, all hardened concrete or foreign materials shall be completely

removed from the inner surfaces of all conveying equipment.

(b) Before depositing any concrete, all debris shall be removed from the space to be occupied by the concrete, all steel reinforcing shall be secured in its proper location, all forms shall be thoroughly wetted except in freezing weather unless they have been previously oiled, and all form work and steel reinforcing shall be inspected and approved by the engineer. (See 15, 16 and 18.)

**Handling.**—24. Concrete shall be handled from the mixer to the place of final deposit as rapidly as possible, and by methods of transporting which shall prevent the separation of the ingredients. The concrete shall be deposited directly into the forms as nearly as possible in its final position so as to avoid rehandling. The piling up of concrete material in the forms in such manner as to permit the escape of mortar from the coarse aggregates will not be permitted. Under no circumstances shall concrete that has partially set be deposited in the work. (See 22.)

**Compacting.**—25. During and after depositing, the concrete shall be compacted by means of a shovel or other suitable tool moved up and down continuously in the concrete until it has all settled into place and water has flushed to the surface. The concrete shall be thoroughly worked around all reinforcing material so as to completely surround and embed the same.

**Cold Weather.**—26. During cold weather, the concrete at the time it is mixed and deposited in the work shall have a temperature not lower than 50 deg. F., and suitable means shall be provided to maintain this temperature for at least 72 hr. thereafter, and until the concrete has thoroughly set. The methods of heating materials and protecting the concrete shall be approved by the engineer. The use of any salt or chemical to prevent freezing will not be permitted.

**Depositing on or Against Set Concrete.**—27. Before depositing new concrete on or against concrete which has set, the forms shall be retightened against the face of the latter, the surface of the set concrete shall be roughened and thoroughly cleaned of foreign matter and laitance, and drenched with water. The new concrete placed in contact with set or partially set concrete shall contain an excess of mortar to insure bond. To insure this excess of mortar at the juncture of the set and newly deposited concrete on vertical or inclined surfaces, the cleaned and drenched surface of the set concrete shall first be slushed with a coating of mortar, not less than one inch thick, composed of one part cement to two parts fine aggregate, against which the new concrete shall be deposited before this mortar has had time to attain its initial set.

**Rubble or Cyclopean Concrete.**—28. After each layer of concrete is placed, and before it has taken its initial set, the stones are to be thoroughly bedded in the soft concrete. No stone shall be placed nearer than one foot to any finished surface; nor nearer than six inches to any adjacent stone. After the stones are in place another layer of concrete shall be placed sufficient to cover the stones to a depth of at least six inches.

When stratified stones are used, they shall be laid upon their natural bed. (See 4, 9b.)

### Depositing Concrete Under Water

**General.**—29. Concrete shall not be deposited in water without the written consent of the engineer. A written statement of the methods and plans of equipment to be used shall be submitted to and approved by the engineer before the work is started. (See 9a, 11, 21.)

**Cofferdams.**—30. Cofferdams shall be sufficiently tight to prevent any current through the space in which the concrete is to be deposited. Pumping will not be permitted while the concrete is being deposited, nor until it has fully set.

**Method.**—31. The concrete shall be deposited by such method as will prevent the washing of the cement from the mixture. In no case shall the concrete be allowed to fall through the water.

**Tremie.**—32. The tremie, where used, shall be about 14 to 16 in. in diameter, and made flanged and put together with gaskets. The initial filling of the tremie shall be done in such manner as not to permit the concrete to drop through the water. It shall be kept filled at all times, and the discharge end raised a few inches at a time as the filling progresses. The greatest care shall be used to prevent the charge being lost in moving the tremie about on the surface of the deposited concrete. In case the charge is lost, the tremie must be withdrawn and refilled.

**Drop Bottom Bucket.**—33. (a) The bucket, where used, shall be of such a type that it cannot be dumped until it rests on the surface upon which the concrete is to be deposited. The frame shall extend below the closed bottom doors so they may open freely downward and outward when tripped. The ends of the bucket shall extend without openings to the bottom of the frame. The top of the bucket shall be open.

(b) The bucket shall be completely filled, and slowly lowered to avoid unnecessary back wash. When discharged the bucket shall be withdrawn slowly until clear of the concrete.

**Bagging.**—34. The bags, when used, shall be of jute or other coarse cloth. They shall be about two-thirds filled with concrete, and shall be carefully placed by hand in a header and stretcher system so the whole mass is interlocked.

**Continuous Operation.**—35. Where possible, the concrete shall be deposited continuously from the time the work is started until it is brought above water level or to the finished surface. The work shall be carried on with sufficient rapidity to insure bonding of the successive layers. The surface of the deposited concrete shall be kept as nearly level as possible.

**Laitance.**—36. Great care shall be exercised to disturb the concrete as little as possible while it is being deposited, to avoid the formation of laitance. On completing a section of concrete, the laitance shall be entirely removed after the concrete has thoroughly set and before the work is resumed.

### Joints

**General.**—37. (a) Instructions given on the plans, in the detailed specifications or schedule governing the work as to location and construction of joints, shall be strictly followed.

(b) When the structures or portions of the structures are designed to be monolithic, they shall be cast integrally, except as hereinafter modified. (See 38a, b, c, d.)

**Construction Joints.**—38. (a) When necessary to provide construction joints not indicated, or specified, such joints shall be located and formed so as to least impair the strength and appearance of the structure. Where conditions require, the joints shall be reinforced as directed by the engineer, in order to secure the necessary bond strength.

(b) Horizontal construction joints shall be prepared at the time the work is interrupted by thoroughly roughening the surface and providing keys by embedding stones which project above the surface, or mortises by embedding timbers which shall be removed before the work of placing concrete is resumed.

(c) At all horizontal or vertical construction joints, the previously deposited surface shall always be roughened and cleaned of all laitance and foreign material before depositing new concrete. (See 27.)

(d) Where girders, beams and slabs are designed to be monolithic with walls and columns, they shall not be cast until four hours after the completion of the walls or columns in order to permit of shrinkage or settlement. In case the columns are structural steel, encased in concrete or concrete columns having flaring heads, the lapse of time to allow for shrinkage or settlement need not be observed. (See 37b.)

**Watertight Joints.**—39. When it is not possible to finish a complete section in one continuous operation, and a watertight joint is required, sheet lead or other metal, not less than six inches wide, and extending the full length of the joint, shall be embedded equally in the two deposits of concrete.

**Sliding Joints.**—40. Where sliding joints are to be provided, the seat shall be finished with a smooth trowel surface and shall not have the superimposed concrete placed upon it until the previously deposited concrete has thoroughly set. Unless otherwise indicated on the plans, or specified, two thicknesses of building paper shall be placed over the bearing before the superimposed concrete is deposited, in order to make a defined sliding joint.

**Expansion Joints.**—41. (a) At all expansion joints, the bond between the two sections shall be complete, and shall be insured by the application of petroleum oil, hot coal tar pitch, or similar material over the entire joint surface of the first deposited concrete.

(b) No reinforcement shall extend across an expansion joint.

(c) Triangular shaped grooves shall be formed in the exposed surface of the concrete at all expansion joints in walls or abutments.

(d) Where expansion joints are formed between two distinct concrete members, and said joint is exposed, it shall be filled with an elastic joint filler of approved quality.

### Surfacing and Finishing

**General.**—42. Except where a special surface or finish is required, the surfacing and finishing shall be done in accordance with the requirements specified for a "Spaded Surface." (See 43a, b, c.)

**Spaded Surface.**—43. (a) The coarse aggregate shall be carefully worked back from the forms into the mass of the

concrete with spades, fine stone forks, bars or other suitable tools, so as to bring a surface of mortar against the form. Care shall be taken to remove all air pockets and to prevent voids in the surface.

(b) Except where otherwise directed by the engineer, face forms shall be removed as soon as the setting of the concrete will permit. (See 17.)

(c) After the removal of the forms, any holes or voids in the surface of the concrete shall be filled with a mortar made of the same proportions of sand and cement as those of the concrete and rubbed smooth and even with the surface with a wooden float. A trowel shall not be used for this purpose. (See 42.)

**Top Surfaces.**—44. (a) Top surfaces shall generally be "struck" with a straight edge or "floated" after the coarse aggregates have been forced below the surface.

(b) Where "sidewalk finish" is called for on the plans, it shall be made by the spreading of a 1 :2 mortar at least ¾ in. thick, and floating this to a smooth surface. This finishing cast shall be put on before the concrete has taken its initial set. For a walk, the surface shall be slightly roughened with a special tool or by sweeping with a coarse broom.

**Wetting Surfaces.**—45. The surfaces of concrete exposed to premature drying shall be kept thoroughly and constantly wetted for a period of at least three days. For wearing surfaces, this period shall be at least ten days.

SPECIAL FINISHES

(Detailed specifications for various special finishes followed.)

## Appendix B—Continued—Specifications for Billet-Steel Concrete Reinforcement Bars

(The specifications submitted by the committee are the same as those of the American Society for Testing Materials for billet-steel concrete reinforcement bars adopted in 1911 and revised in 1912, 1913 and 1914, except as to provisions of clauses given in full below and as to provision for twisted bars and Bessemer steel, which was excluded as noted in paragraphs 1(c) and 3(a), respectively.)

**Material Covered.**—1. (a) These specifications cover two classes of billet-steel concrete reinforcement bars, namely: plain and deformed.

(b) Plain and deformed bars are of three grades, namely: structural-steel, intermediate and hard.

(c) Twisted bars will not be accepted under these specifications.

**Basis of Purchase.**—2. The structural-steel grade shall be used unless otherwise specified.

MANUFACTURE

**Process.**—3. (a) The steel shall be made by the open-hearth process.

(b) The bars shall be rolled from new billets. No re-rolled material will be accepted.

**Test Specimens.**—10. Tension and bend test specimens for plain and deformed bars shall be taken from the finished bars, and shall be of the full thickness or diameter of bars as rolled.

(Note.—This clause as appearing in the A.S.T.M. specification contains the following qualification which is omitted from the A.R.E.A specification: "except that the specimen for deformed bars may be machined for a length of at least nine inches if deemed necessary by the manufacturer to obtain uniform cross-section.")

## Appendix C—Methods of Depositing Concrete Under Water

1. In general, where possible, the depositing of concrete under water should be avoided, even if such action results in additional expense and possible delay to the work. There is always considerable uncertainty as to the results obtained, and, where conditions will permit, the additional expense and delay of avoiding it is well warranted.

2. In view of this uncertainty, the need of close supervision by men competent to handle this class of work is of the utmost importance, and concrete should never be deposited under water without experienced supervision. Many failures which have occurred, especially where the structure is located in sea water, can be directly traced to ignorance or lack of supervision.

3. It is desirable that the concrete be deposited continuously from the time the work is started until it is brought above the water level, or to the finished surface, which can later be cleaned of laitance in the air after the concrete has hardened.

Of the methods used, the following give the best results:

1. The concrete is lowered in large buckets having a hinged bottom which sets sufficiently far above the lower edge of the bucket that it may open freely downward and outward when the bucket reaches the surface upon which the concrete is to be deposited. The top of the bucket is left open, and care is taken to see that the bucket is completely filled before lowering. Efforts made to use a closed top bucket have not been successful, due to the disturbance of the deposited concrete by inrush of water as the bucket is withdrawn.

2. The concrete may be passed through a vertical tube or tremie reaching down to the surface upon which the concrete is to be deposited. In this case the tremie should be kept filled with concrete at all times, and the flow should be as nearly continuous as practicable. When the operation starts, the tremie should be filled in such manner that the concrete is not permitted to drop through the water. This is accomplished in several ways: One is to place the bottom of the tremie in a box, partially filling it with concrete so as to seal the bottom, then lowering the tremie into the position in which it is to be used. Another method is to plug the tremie with cement sacks or other material, which will be forced down as the tube is filled with concrete. A third method is to plug the end of the tremie with a cloth sack filled with cement. In case the charge is lost, the tremie should again be filled as at first.

3. Jute or cloth bags, from two-thirds to three-fourths filled with concrete, have been used successfully. These are placed in a header and stretcher system so that the whole mass is interlocked.

4. Where it is difficult to construct a cofferdam or monolithic work is not required, premolded concrete blocks of large dimensions have been used successfully.

5. A concrete depositing bag made of canvas or other suitable material is a variation of the bucket system. This is filled with concrete and the mouth of the bag closed by one turn of a line so looped that a pull on the line will release it. The bag is lowered mouth down to the surface upon which the concrete is to be deposited, and a pull on the line opens the bag and permits the concrete to be deposited. This method does not have the disadvantage of the closed top bucket, since the bag will collapse as the concrete flows out.

Methods to be avoided:

1. There are a number of other methods that have been used, such as depositing directly through the water; depositing a portion of the concrete by one of the above methods in the corner of the form and the balance progressively from wheelbarrows or buckets on the sloping surface, thus gradually filling the form; allowing the concrete to partially set in air and then depositing it in a plastic condition; depositing the concrete dry without the use of water; attempting to grout a foundation composed of rip-rap or coarse gravel by means of pipes sunk at intervals into the foundation. Although occasionally fair results have been obtained, all of these methods are dangerous, as they almost uniformly result in segregation of the materials or the washing out of the cement.

*Precautions.*—Concrete to be deposited in water should be of a richer mixture than when deposited in air, and a leaner mixture than 1-2-4 should not be used.

The aggregate should be free from loam or other material, and it is preferable that washed aggregates be used where possible to obtain them. Washed gravel of somewhat smaller size than used in open air concrete will give the best results.

In depositing concrete under water it is imperative that the water be still and that the concrete shall not be exposed to current until it is fully set. This requires that a cofferdam be constructed in such manner as to insure quiet water within the cofferdam. One of the essentials of depositing concrete by any of the above methods is that the concrete be disturbed as little as practicable during the depositing, thus avoiding the formation of laitance. It is impracticable in depositing concrete in water by any method to entirely avoid laitance, and it is therefore necessary on completing a section of concrete to see that the laitance is entirely removed after the concrete has thoroughly set and before the work is resumed. For this reason when a job is started the concrete should be deposited continuously until the finished surface is reached or the concrete brought above the water level so that the laitance may be removed in the air, as it is difficult, if not impracticable, to entirely remove it under water. The formation of construction joints under water should be avoided.

The ordinary precautions used in depositing concrete in the air are not sufficient when depositing concrete in water, and additional care must be observed in the latter case to prevent segregation of the materials, the formation of laitance, and to insure proper setting of the mass. Because of the fact that cold retards setting, the concrete should not be deposited in water the temperature of which is low enough to cause serious retardation. Concrete should be thoroughly mixed before it is deposited in water and, therefore, hand mixing should never be permitted, but a batch mixer used.

### Discussion

J. J. Yates (chairman): The first subject is the revision of the Manual, given in Appendix A, and the committee recommends that it be approved.

(Mr. Yates then read the detailed omissions, revisions and additions as presented in the report and moved their adoption, as given in the committee report.)

J. L. Campbell (E. P. & S. W.): I ask the committee why it limited the definition of crushed slag to blast slag?

Mr. Yates: That is the only kind of slag provided for in the specifications.

Mr. Campbell: Blast furnace slag is a very inferior material, as I understand it, compared to slag that is made in the western part of the United States in the smelting of the precious metals. I move that the definition be general so as to include all slags.

W. S. Lacher (*Railway Age*): I believe the reasons for that restriction in the definition is a consequence of the restriction to the use of the words "blast furnace" in the specifications as we have drawn them. The reason for that is that the committee did not receive a sufficient amount of information concerning the smelter slags to warrant it, in its opinion, to include the term smelter slag in the specifications for material in the new specifications it is now submitting. It may be that some additional work of the committee will bring out sufficient information to warrant that addition at some later date.

Mr. Campbell: I am not insistent at all that this change be made at this time, but I do make the suggestion that I think the Association ought to get right on the slag proposition.

(Mr. Yates' motion was carried.)

Chairman Yates: The next subject is Specifications for Plain and Reinforced Concrete and for Steel Reinforcement, and the committee recommends that they be accepted and printed in the Manual, in place of the present specifications.

S. T. Wagner (P. & R.): The second paragraph relating to "Fine Aggregate" requires a strength in briquettes, which in eastern Pennsylvania and New Jersey makes it difficult to get. In other words, the tests the speaker has been familiar with in the last five or six years will show that a large proportion of the ordinary sands in that location do not comply with the specification of 100 per cent of the strength of the standard.

Chairman Yates: This same criticism has again been considered by the committee recently and it is the general impression of the committee that the proposed requirement can be usually met, and it is not thought advisable to reduce the specification due to the inability to get sand that will meet the conditions locally. I move the acceptance and printing in the Manual of the specifications for concrete, plain and reinforced.

(The motion was seconded and carried.)

Chairman Yates then presented the Specifications for Billet-Steel, Concrete Reinforcement Bars.

W. H. Courtenay (L. & N.): May I inquire of the chairman, what is the objection to cold twisted bars in the specification?

Chairman Yates: The cold twisted bar did not seem to find favor. The reasons given were the insufficiency of bond stress, and the general effect of cold twisting on the metal. The great majority of answers we got from railroads had it excluded, so the specifications have excluded it.

I. L. Simmons (C. R. I. & P.): Do I understand it is the intention of the Committee to reject cold twisted bars entirely? There are a great many cold twisted bars used by railroads.

T. L. Condron: I think the reason the committee has excluded cold twisted bars from the specification is because of the result of the tests made by several of the universities, showing that the bond of a twisted bar was really less than the bond of a plain bar. If a twisted bar does not give a greater bond value in concrete, the reason for its use is that much less.

Mr. Simmons: It would be practically impossible to get deformed bars any time you wish to use them, and it would become necessary to get cold twisted bars. I am not opposed myself to the cold twisted bar. I have used it for 15 or 20 years. I cannot see any reason why the committee should reject this specication for cold twisted bars. We have to use it, and as long as we have to use it, why not have a specification to guide us in our work?

Prof. A. N. Talbot (U. of Ill.): Mr. President, I am glad to see the committee make an attempt to exclude the cold twisted bar. As stated by Mr. Condon, the bond given by the cold twisted bar is not better, or perhaps not as good as that of the plain bar. It is quite clear, I think, from the tests that have been made that the twisted bar is not effective in giving a bond such as a deformed bar will give, so its use is really being given under a misapprehension of what happens. The second point referred to of the increased yield point of the twisted bar over the plain bar is also due to a misapprehension. When a bar is twisted, the increase in its strength is not given over the whole section. The outer portion of it, or certain parts of the outer portion of it are stressed beyond the elastic limit as its yield point raises. There is, however, in the interior, a considerable portion which has not been stressed beyond the yield point, and has not had the yield point attained.

We have then the anomaly of a bar which has not the same yield point throughout. It then has a certain modulus of elasticity before it has reached the yield point, and beyond that a decreased modulus of elasticity. I am glad to know that engineers generally are coming to recognize that there is no advantage in using twisted bars.

Chairman Yates: I move the adoption of the specifications for billet-steel concrete reinforcement bars as they apear and their printing in the Manual. (The motion was seconded.)

E. A. Frink (S. A. L.): Our specifications are getting a little bit too diverse. We will have presented here this afternoon, if we go through with the program, specifications for material for track spikes, steel tie plates of two grades and screw spikes. We now have reinforcing bars, bridge steel and electric transmitting towers. Now, if you compare the specifications that have been submitted for the material for those various things, you will find that there is absolutely no harmony whatsoever between any two of them, except in a few isolated cases. It seems to me to be unnecessary to have so many different units of strength from which to make these several articles. I cannot see any reason why the material for track spikes should not conform with the material for screw spikes. Neither can I see why the material for reinforcing bars for concrete should not conform to the strength of the material used in steel bridges. There has been a long discussion going on for a number of years as to the merits and demerits of round bars and deformed bars. I have yet to see the necessity, or possibly I might say the advantage of the deformed bar except in special cases.

One of the things that the railroads, as well as everybody else, are suffering from today is high prices. Every time you ask for an additional type or kind of material you increase the cost of your material.

I move that the following matter at the end of the specification on par. 1 be omitted and replaced by the following: "The material for concrete reinforcement shall conform strictly to the structural material as specified for steel bridges in the specification of the committee on iron and steel structures."

(The motion was seconded.)

Chairman Yates: I think one of the reasons for providing specifications for steel used for different purposes is to meet market conditions as far as practicable. There are a number of other reasons, I might say. For instance, some materials require different working conditions, require different steel.

I hope this motion will not prevail. We all realize the trouble we have had in getting material under the present specifications. We must meet to some extent market conditions. The committee has taken it up with the manufacturers, with the intent of changing some of the conditions, and it feels that it has gone about as far as it can, and still have a specification that will meet market conditions.

A. C. Irwin (Portland Cement Assoc.): The cold twisted bar is really subjected to an automatic test, so that in addition to the specific test you have practically an automatic test of the bar. In a twisted bar you have one in which the bond strength is practically equivalent to a plain bar. At the same time you have a bar that has been automatically tested, because it was twisted, and if it is not a good bar it will break in the twisting.

Mr. Condron: Mr. President, your committee has given a great deal of study to this matter, and these specifications seem to cover what Mr. Frink wants. If Mr. Frink wants to use in his work structural steel, he has a specification for it. Some other engineers will want to use the hard grade. It is on the market, they can purchase it, it is not being made to order, but they want a proper specification for ordering it under. Now it seems to me that this specification which has been in existence for at least five years—it is not anything new—the American Society of Testing Materials has threshed this all out and this is that specification and this material, and this is to be purchased in every city in the United States.

There has been a reference made to the twisting of bars testing them. That is salesmen's talk. There isn't any virtue to it in the matter of reinforcing bars. I haven't any objection to square twisted bars in bridges or anything else, but it costs a lot of money to have them twisted, and they do not do you any good. We want to bring to your attention the fact that you are paying $5 a ton for a mechanical operation from which you are getting no benefit. If you gentlemen are wise enough to know whether you have a hot or a cold twisted bar when you see it, all right.

(Mr. Frink's motion was put and defeated.)

Mr. Campbell: Mr. President, I now move that specification (c) under "Material Covered" be amended to read as follows: "Hot twisted bars will not be accepted under these specifications." If I understand correctly, at the opening of this discussion, these specifications as they stand differ from other specifications in that they do not include twisted bars, and if we could now align ourselves with those specifications so that we would not be in conflict with them altogether, I believe it would really be a step in advance.

(Mr. Campbell's motion was put and defeated.)

(The original motion was then approved.)

Chairman Yates: I move the adoption of the committee's report on "Methods of Depositing Concrete Under Water," and its printing in the Manual.

(The motion was carried and the committee dismissed with thanks.)

# Report on Uniform General Contract Forms

THE COMMITTEE DEVOTED most of its attention during the year to a form of lease agreement for industrial sites and obtained specimen forms from various railroads. As a result of this work, a form of lease agreement was drawn up but not all of the members of the committee were in accord as to all of the articles incorporated. In view of the fact, however, that co-operation with a committee of another association was believed to be desirable before final action is taken, and that the committee is in agreement as to the larger number of the articles incorporated in the submitted form, it was considered best under all the conditions to incorporate the form of lease agreement for industrial site in the report.

Committee: E. H. Lee (C. & W. I.), chairman; C. A. Wilson (Cons. Engr.), vice-chairman; C. Frank Allen (M. I. T.), A. O. Cunningham (U. S. R. A.), W. D. Faucette (C. C. C. & St. L.), G. E. Gifford (Brg. Builders' Soc.), J. C. Irwin (B. & A.), A. S. Kent (C. I. & L.), H. A. Palmer (G. T.), C. J. Parker (N. Y. C.).

## Discussion

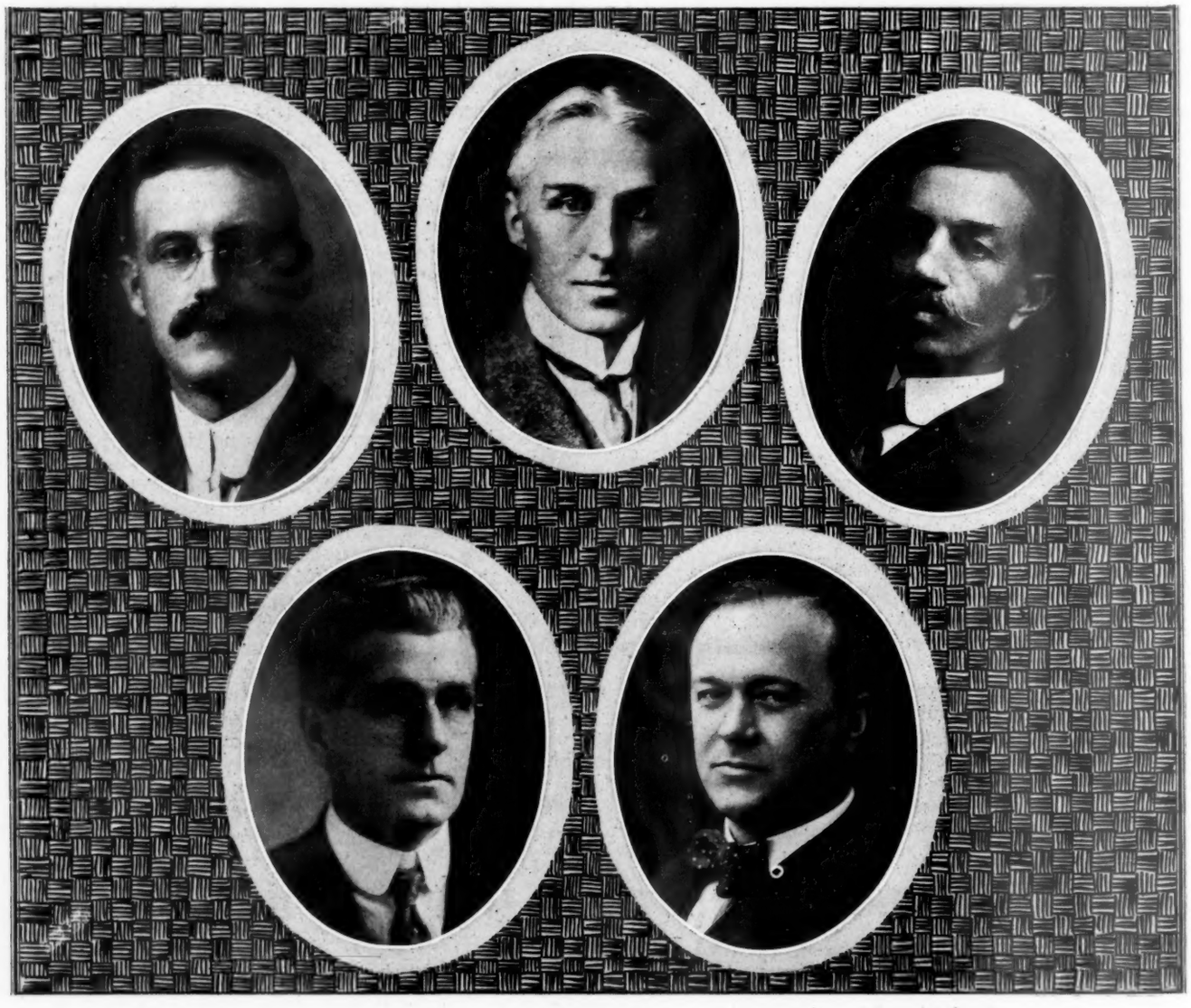
This subject was considered in committee meeting, but for the reasons set forth in the report we were unable to deal with it conclusively. It seems to the committee better to present the report as it has been presented to this association as information. Before making a mo-

tion to that effect I wish to say that the committee, if the motion is adopted, will welcome criticisms and suggestions. I move that the report on form of lease agreement, for industrial site. be received as information. (The motion was seconded and carried, and the committee was excused with the thanks of the association.)

# Five New A. R. E. A. Committee Chairmen

## Are Leaders in the Work on Roadway, Signs and Crossings, Masonry, Ballast and Standards

FIVE NEW CHAIRMEN APPEAR among the personnel of the committees of the American Railway Engineering Association this year, four replacing others on standing committees and one leading a new committee. On the basis of the 22 standing and 1 special committee in existence a year ago, this indicates a turnover of chairmen about once every six years, which is slow to say the least.



J. J. Yates A. Crumpton E. A. Frink
H. L. Ripley J. R. W. Ambrose

**New Chairmen of A. R. E. A. Committees**

Those heading new committees this year are J. R. W. Ambrose, chief engineer of the Toronto Terminals Company, Toronto, Can., who is in charge of the Roadway committee; H. L. Ripley, valuation engineer of the New York, New Haven & Hartford, Boston, Mass., who is chairman of the Ballast committee; J. J. Yates, bridge engineer of the Central Railroad of New Jersey, New York City, who is directing the Masonry committee; Arthur Crumpton, valuation engineer of the Grand Trunk, Detroit, Mich., who is chairman of the Committee on Signs, Fences and Crossings, and E. A. Frink, principal assistant engineer of the Seaboard Air Line, with headquarters at Norfolk, Va., who heads the committee on Standardization which was organized late in 1918.

The selection of Mr. Ambrose to direct the Roadway committee is a recognition of his long membership on this committee and his extended experience in the type of railway construction problems presented to this com-

mittee for consideration. As chief engineer of the Toronto Terminals, where he is in charge of the new Toronto Union Station, which is being built jointly by the roads entering that city, and previously engaged in construction on other railways in Canada, Mr. Ambrose is familiar with roadway building under difficult conditions. He has been a member of the Roadway committee for 10 years, having first been appointed to this committee in 1910. He was chairman of a sub-committee for the three years from 1915 to 1917, inclusive.

While the subjects assigned to the Ballast committee for consideration during the past year are somewhat remote from the work which has engaged the attention of its chairman, Mr. Ripley, recently, he has been a member of this committee since 1916, was a chairman of a sub-committee in 1917, and again in 1919. He has been active in the work of this committee and has contributed materially to its reports during the last two or three years.

Arthur Crumpton's appointment as chairman of the Committee on Signs, Fences and Crossings was a natural promotion from the position of vice-chairman, which he has held for three years. Mr. Crumpton has been a member of this committee continuously since 1913.

The selection of J. J. Yates as chairman of the Masonry committee is also a recognition of extended service on a committee, as he has been a member of this committee since 1912. Mr. Yates was chairman of a sub-committee of this committee in 1916 and has been vice-chairman of the committee for the last three years. He has also been a representative of the association on the Joint Committee on Cement Specifications and has recently been elected vice-chairman of the new joint committee on Concrete and Reinforced Concrete. As assistant chief engineer of the Central Railroad of New Jersey and for a number of years bridge engineer of that road, his experience has been directly in line with the work of this committee.

E. A. Frink, who was appointed chairman of the recently-created Committee on Standardization, has long been an advocate of such a committee. His appointment in charge of the work of harmonizing the specifications of the association with trade practices and with those of the individual roads offers a wide field for service on the part of the association.

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## D. B. Wright Changes Position

D. B. Wright, for several years sales representative with the Lehon Co., has been appointed sales representative for the Paul Dickinson Company, with headquarters at 34th St. and S. Artesian Ave., Chicago.

## Missouri Pacific Men Here

A delegation of 20 of the officers of the engineering and maintenance of way departments of the Missouri Pacific are in attendance at the convention and are also inspecting the exhibits at the Coliseum.

## Kansas City Sectional Committee Meeting

A meeting of the Kansas City Sectional Committee of the Signal division will be held in the general assembly room of the Kansas City Union Terminal Building on March 29, beginning at 10 a. m. H. F. Roach of the Reinforced Rail Joint Company, St. Louis, Mo., will give a lecture on fibre for track installation and a representative of the Thos. A. Edison Company, Inc., Primary Battery Division, will talk on the chemistry in handling primary batteries.

# A. R. E. A. Registration

THE REGISTRATION OF American Railway Engineering Association members yesterday totaled 411, in addition to 123 guests, a grand total of 534. This is 41 in excess of the registration on the first day last year, which was a record up to that time.

### Members

Abbott, F. E., Insp. Engr., Lackawanna Steel Co., Buffalo, N. Y.
Albright, C. C., Asso. Prof. C. E., Purdue Univ., LaFayette, Ind.
Alfred, F. H., Pres. and Gen. Man., P. M. R. R., Detroit, Mich.
Ambrose, J. R. W., Chief Eng., Toronto Term. Ry., Toronto, Ont., Canada.
Ames, Azel, Kerite Insulated Wire & Cable Co., New York City.
Amoss, F. X., Can. Gov. Rys., Winnipeg, Can.
Anderson, Arthur, Instrumentman, N. Y. C. R. R., Chicago, Ill.
Andrews, Geo. W., Asst. to Ch. Eng. Maint., B. & O. R. R., Baltimore, Md.
Andrews, J. T., Asst. Eng., B. & O. R. R., Baltimore, Md.
Angerer, Victor, Vice-Pres., Wm. Wharton, Jr. & Co., Easton, Pa.
Angier, F. J., Supt. Tim. Pres., B. & O. R. R., Baltimore.
Armour, Robert, Masonry Eng., Grand Trunk Ry., Montreal, Can.
Armstrong, H. J., Asso. Prof. C. E., Armour Inst., Chicago, Ill.
Arn, W. G., Asst. Eng. M. W., I. C. R. R., Chicago.
Atwill, A. Lee, Asst. Eng., Chicago & Western Indiana R. R., Chicago.
Auryansen, F., Bridge Eng., Long Island R. R., Jamaica, N. Y.
Baird, F. A., Div. Eng., A. T. & S. F. R. R., Slaton, Texas.
Baird, R. C., Asst. Eng., C. R. I. & P. R. R., Chicago, Ill.
Baldridge, C. W., Asst. Eng., A. T. & S. F. Ry., Chicago.
Baldwin, A. S. (Past-President), Vice-President, I. C. R. R., Chicago.
Baldwin, R. A., Prin. Asst. Engineer, C. N. R., Toronto, Canada.
Baldwin, Springfield, Ch. Eng., Georgia & Florida R. R. Augusta, Ga.
Balliet, H. S., Asst. Terminal Manager, Gr. Cen. Ter., and Sig. Eng., N. Y. C. R. R., New York.
Baluss, F. C., Eng. B. and B., D. M. & N. Ry., Duluth, Minn.
Bardwell, R. C., Chief Chemist, M. P. R. R., St. Louis, Mo.
Barnhart, E. H., Asst. Engineer, B. & O. R. R., Baltimore, Md.
Barrett, W. C., Div. Engineer, Lehigh Valley R. R., Sayre, Pa.
Bassett, J. S., Asst. Eng., M. P. R. R., Nevada, Mo.
Batchellor, F. D., Div. Engineer, B. & O. R. R., Chicago, Ill.
Bates, Onward, Con. Eng., Chicago.
Beckett, F. T., Eng. M. of W., C. R. I. & P. Ry., El Reno, Okla.
Beye, John C., Bureau of Val., I. C. C., Chicago.
Bissell, F. E., Cleveland, Ohio.
Black, G. F., Eng. M. of Way, Maine Cen. R. R., Portland, Me.
Blackie, G. F., Asst. Ch. Eng., N. C. & St. L. Ry., Nashville, Tenn.
Blaiklock, M. S., Eng. M. of W., Grand Trunk Ry., Montreal, Can.
Blanchard, A. M., Office Engr., Grand Trunk Ry., Detroit, Mich.
Blum, Bernard, Eng. M. W., N. P. R. R., St. Paul, Minn.
Boardman, H. E., Asst. Eng., Val. Dept., N. Y. C. Lines, New York, N. Y.
Bond, F. L. C., Chief Engineer, G. T. Ry., Montreal, Can.
Breckinridge, W. L., Asst. Chief Eng., C. B. & Q. R. R., Chicago. Ill.
Bremner, Geo. H. (Treasurer), District Engineer, Bureau of Valuation, Interstate Commerce Commission, Chicago.
Brewer, W. A., Chicago.
Briggs, Z. M., Asst. Eng., Penna. Lines, Pittsburgh, Pa.
Brown, A. V., Eng. M. W., Lake Shore Electric Ry., Sandusky, Ohio.
Brown, C. B., Asst. Gen. Man. & Chf. Eng., Can. National Rys., Moncton, Can.
Brown, H. C., Jr., Chicago.
Brown, J. M., Eng. C., C. R. I. & P. Ry., Chicago.
Brumley, D. J., Chief Corp. Eng., I. C. R. R., Chicago.
Bryan, C. G., Asst. Eng., I. C. R. R., Chicago, Ill.
Bryan, Hardy, Asst. Eng., N. P. R. R., St. Paul, Minn.
Buck, C. M., Div. Eng., A. T. & S. F. Ry., Topeka, Kan.
Buehler, Walter, Cons. Eng., The Barrett Company, Chicago.
Burke, M. J., Asst. Eng., Big Four Ry., Indianapolis, Ind.
Burns, J. F., Asst. Eng., M. W., L. & N. R. R., Louisville, Ky.
Burpee, Moses, Ch. Eng., B. & A. R. R., Houlton, Me.
Burrage, W. H., Pilot, Val. Dept., N. Y. C. & St. L. R. R., East Cleveland, Ohio.
Burt, J. W., Eng., M. W., C. C. C. & St. L., Indianapolis, Ind.
Burton, W. J., Asst. Val. Eng., Mo. Pac. R. R., St. Louis, Mo.
Bush, Lincoln, East Orange, N. J.
Butterworth, A. S., Ch. Eng., G. F. & A. Ry., Pensacola, Fla.

Campbell, J. L. (Director), Ch. Eng., E. P. & S. W. R. R., El Paso, Texas.
Carroll, G. A., Div. Eng., C. R. I. & P. R. R., Eldon, Mo.
Chamberlain, O. P., Prest., C. & I. W. R. R., Chicago.
Carpenter, A. W., Asst. Val. Eng., N. Y. C. R. R., New York.
Chandler, Charles, Asst. Bridge Eng., I. C. R. R., Chicago, Ill.
Christian, W. A., Senior Civil Engineer in charge of Track and Roadway, I. C. C., Chicago, Ill.
Church, S. R., Man. Research Dept., The Barrett Co., New York City.
Clark, M. B., Div. Eng., A. T. & S. F. Ry., Needles, Calif.
Clark, W. A., Chief Engineer, D. & I. R. R. R., Duluth, Minn.
Clements, M. F., Bridge Eng., Nor. Pac. Ry, St. Paul, Minn.
Cleveland, G. C., Chief Eng., N. Y. C. R. R., West of Buffalo, Cleveland, O.
Coburn, Maurice, Eng. M. of W., Penna. Lines, Indianapolis.
Collette, E. L., Asst. Eng. M. W., St. L.-S. F. R. R., Springfield, Mo.
Condron, T. L., Consulting Engineer, Monadnock Block, Chicago.
Conner, J. K., Chief Eng., L. E. & W. R. R., Indianapolis.
Cook, C. C., Maintenance Eng. (Corp.), B. & O. R. R., Baltimore, Md.
Cook, O. U., Met. Eng., Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Coon, C. J., Track Eng., Gr. Cen. Terminal, N. Y. C. R. R., New York.
Corrigan, G. W., Division Engineer, Southern Pacific Company, Los Angeles, Cal.
Courtenay, W. H. (Director), Chief Engineer, L. & N. R. R., Louisville, Ky.
Cox, J. B., Consulting Engineer, Chicago, Ill.
Crugar, E. L., Dist. Eng., I. C. R. R., New Orleans, La.
Crumpton, Arthur, Val. Eng., Grand Trunk R. R., Montreal, Can.
Cunningham, C. C., Insp. Roadway & Str., C. R. I. & P. R. R., Chicago.
Curd, W. C., Con. Eng., Chicago.
Curtis, L. G., Chief Engineer, Adj. Division, B. & O. R. R., Baltimore.
Curtiss, L. B., Asst. Eng., Nor. Pac. Ry., St. Paul, Minn.
Cushing, W. C. (Past-President), Eng. of Standards and Valuation, Pennsylvania Railroad System, Philadelphia, Pa.
Dare, C. E., Res. Eng., W. S. Ry., Alexandria, Va.
Davidson, Geo. M., Chemist & Eng. Tests, C. & N. W. Ry., Chicago.
Davis, A. L., Prin. Asst. Eng., I. C. R. R., Chicago, Ill.
Delamere, C. T., Eng. Const., C. P. R., Montreal, Canada.
Dennis, Walt, Division Eng., Wabash R. R., Moberly, Mo.
Dewey, S. J., Asst. Signal Engineer, Big Four Ry., Cincinnati, O.
Dillenbeck, Clark, Asst. Ch. Eng., P. & R. Ry., Philadelphia, Pa.
Dixon, H. A., Chf. Eng., Canadian Nat. Rys., Western Lines, Winnipeg, Can.
Dixon, J. M., St. Paul, Minn.
Donahey, J. A., Cleveland, Ohio.
Douglas, H. T., Jr., Chief Eng., C. & A. R. R., Chicago.
Downs, J. L., Roadmaster, I. C. R. R., Champaign, Ill.
Duffy, C. M., Asst. Sig. Eng., C. R. I. & P. R. R., Des Moines, Ia.
Earle, T. E., Res. Eng., C. C. C. & St. L. R. R., Union City, Ind.
Eck, W. J., Sig. and Elec. Supt., Sou. Ry., Washington, D. C.
Edgerton, H. H., Asst. Eng., C. G. W. R. R., Chicago, Ill.
Elder, J. D., Div. Eng., M. C. R. R., Niles, Mich.
Eliott, Leigh B., Act. Eng. M. W., Big Four Ry., Indianapolis, Ind.
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Bacon, R. L., Asst. Engr., C. C. C. & St. L., Cincinnati, O.
Bakhetder, F. L., Copper Range, Houghton, Mich.
Baldwin, P. G., Contractor, Warren, Ohio.
Beammlief, A., Supr. of Track, G. T., Ottawa, Ont.
Bertram, H. A., Div. Engr., C. & O., Peru, Ind.
Biezick, J. W., Couley Frog & Switch Co., Memphis, Tenn.
Bishop, F. J., Asst. Engr., L. S. & I. R. R.
Bloom, J. G., Supt., El Dorado, Ark.
Bobbitt, F. W., Asst. Supt. Maint., C. P., Houston, Texas.
Botts, A. E., Div. Engr. C. & O. Huntington, W. Va.
Bowler, R. W. E., Supr. of Track., P. R. R., Washington, D. C.
Briggs, E. L., Asst. Engr., A. T. & S. F., Chicago.
Brink, E. B., Supt., B. & O., Tipton, Ind.
Bronson, C. B., Asst. to D. E. Dudly, Cons. Engr., N. Y. C. Lines, N. Y. City.
Burchett, R. R., Chesapeake & O., Logan, W. Va.
Causland, C. J., Ch. Elect., Chicago.
Chase, John A., Asst. Engr. of Structures, B. & O., Boston, Mass.
Cox, R. J., National Carbon Co., Louisville, Ky.
Dailey, E. B., Southern Pacific Co., Houston, Tex.
Davenport, G. L., Asst Engr., A. T. & S. F., Los Angeles, Calif.
Davis, J. H., Electrical Engr., B. & O., Baltimore, O.
Davis, T. H., Prin., Asst., Engr., Indianapolis St. Ry., Indianapolis, Ind.
De Vou, James L., Mgr., Eastern Central Dept. Am. Bridge Co., Pittsburgh.
Draver, Franklin, Div., Engr., P. R. R., Baltimore, Md.
Edwards, W. H., Pilot Engr., B. & O., Wheeling, W. Va.
Espenshode, Trav. Val. Agt., C. & N. W., Chicago.
Ekberg, C. E., Draughtsman, Bridge Dept., N. P., Minneapolis, Minn.
Ellis, O. F., Asst. Engr., Oklahoma Ry., Oklahoma City.
Fairbank, L. J., Supvr., P. R. R., New Brunswick, N. J.
Fairle, T. M., Railway Engineer, Hydra Electric Power Co., Ontario.
Fenley, W. H., Kerite Insulated Wire & Cable Co., Chicago.
Flint, C., Asst. Engr., C. P., Winnipeg.
French, H. H., Engineering News Record, Chicago.
Freygang, A. H., Div. Engr., B. & O., Grafton, W. Va.
Frohman, L. C., Prin. Asst. Engr., Fla. East Coast, St. Augustine, Fla.
Gemmill, W. A., Master Carpenter, P. R. R., Willamsford, Pa.
Gibson, H. R., Div. Engr., B. & O., Dayton, O.
Gibson, P. H., Supt. Track, C. & O., Chicago.
Gilman, A. F., Asst. Engr., C. St. P., M. & O. Ry.
Green, D. H., National Carbon Co., Cleveland, O.
Griffin, A. M., Architect. A. C. G., Wilmington, N. C.
Groff Jr., W. B., Supr., P. R. R., Watsontown, Pa.
Goltra, P. P., Secy. Treas., The Goltra Tie Co., Cleveland, O.
Hand, Chas. E., G. F. W. S., A. T. & S. F., Amarillo, Tex.
Harris, B. B., Supr., P. R. R., Philadelphia, Pa.
Harrison, F. O., Secy. to Engr., M. of W., El Reno, Okla.
Haupt, Edw., Pres. Strobel Steel Const. Co., Chicago.
Hawley, Wm. E., Asst Engr., D. M. & N., Duluth, Minn.
Henkel, C. C., Asst. Supr., N. Y. C., Buffalo, N. Y.
Hill, Walter A., Asst. Engr., C. B. & Q., Val Dept., La Grange, Ill.
Hovey, O. E., Engr. American Bridge Co., N. Y. City.
Holtman, D. F., Assoc. Editor, The American Contractor, Chicago.
Hunter, I. W., Div. Engr., C. & E. I., Danville, Ill.

Hurst, C. M., The Hurst Automatic Switch & Signal Co., St. Louis, Mo.
Jeffords, L. S., Asst. Engr., A. C. L., Savannah, Ga.
Jefferies, G. C., Div. Engr., A. T. & S. F., Clovis, N. M.
Jone, F. A., Asst. Engr., B. & O., Needham, Mass.
Kaufman, R. L., Contracting Engr., Chicago.
Keen, Willard, Roadmaster, A. T. & S. F., Carlsbad, N. M.
Kingsland, E. B., Pilot Engr., Nickel Plate, Cleveland, Ohio.
King, Coleman, Supr. Long Island, Jamaica, N. Y.
Kronsburg, A. V., Chicago.
Kulp, C. Stanley, Ingersoll Rand Co., Los Angeles, Calif.
Laird, A. N., Ch. Draughtsman, G. T., Detroit.
Lechty, C. A., C. & N. W., Chicago.
Long, Gery, Wheeling, W. Va.
Mabely, J. B., Asst. to Engr., M. of W., R. I. R. R., El Reno, Okla.
Mann, J. H., Supr. Track, C. & O., St. Alborn, W. Va.
Marsh, C. P., Acting Engr. of Structures, N. Y. C., N. Y. City.
McClurg, J. G., Draftsman, A. T. & S. F., Chicago.
McCue, G. C., Gen. Supr., B. & B., G. T., Ottawa, Ont. Kan.
McDonald, B. M., Div. Engr., N. Y. C. R. R., Chicago.
McKibben, T. H., Pilot Engr., A. T. & S. F. Ry., Topeka,
Michel, C. F., Contractor, Erie R. R.
Morse, F. T., A. T. & S. F., Topeka, Kans.
Morton, L. L., Asst. Engr., L. & N., Louisville, Ky.
Mumford, R. W., C. & O., Ashland, Ky.
Nelson, Wilbur O., B. & O. R. R., Pittsburgh.
Osborne, A. J., Roadmaster, A. T. & S. F., Clovis, N. M.
Palloch, A. L., A. T. & S. F., Belen, N. M.
Pank, W. C., Asst. Engr., I. C., Chicago.
Pemsten, J. O., Supt. of Power, Dist. of Ind., Union Traction, Anderson, Ind.
Penrod, Jr., A. J., Signal Supr., B. & O., Wheeling, W. Va.
Redding, A. H., President Engr., Erie, Chicago.
Regan, M., Supvr. Track, C. & O., Covington, Ky.
Redmond, A. U., Dist. Engr., National Ry., Winnipeg.
Robson, T. B., Roadmaster, L. & N., Evansville, Ind.
Rockwood, N. C., Editor of Rock Products, Chicago.
Rohier, J. A., Road Master, Winslow, Ariz.
Rohod, E., Asst. Engr., Wabash, St. Louis, Mo.
Rice, R. H., Prin. Asst. Engr., Board of Supervising Engineers Chicago Traction, Chicago.
Roby, J. A., A. T. & S. F., Marceline, Mo.
Sheffield, Ed., Sig. Supr., H. & T. C., Ennis, Tex.
Shiley, Wm., L. & N., Evansville, Ind.
Smith, Chester K., Regional Engr., N. W. Region, U. S. R. A., Chicago.
Smith, G. S., Asst. Engr., Mo. Pac., St. Louis, Mo.
Soans, J. H., Div. Engr., C. P., Nelson, British Columbia.
Stanley, C. A., Supvr., C. & O., Richmond, Va.
Stark, P. W., Roadmaster, L. & N., Evansville, Ind.
Stoll, H. E., Sales, Bethlehem Steel Co., Bethlehem, Pa.
Strachan, G. M., Asst. Engr., A. T. & S. F., Chicago.
Suesserolt, J. L., Asst. Engr., B. & O R. R., Pittsburgh.
Swartz, W. G., Asst. Engr., G. T., Montreal.
Thackray, Geo. E., Cambria Steel Co., Johnstown, Pa.
Vincent, J. I., Strauss Bascule Bridge Co., New York City.
Walter, F. J., Engr. Fuel & Water Supply, N. C. & St. L., Nashville, Tenn.
Walters, H. N., Div. Engr., C. & O., Covington, Ky.
Wardle, J. D., Ch. Engr., Ia. Ry. & Lt. Co., Cedar Rapids, Ia.
Webster, I. W., Asst. Engr., E. J. & E., Joliet, Ill.
Weymouth, F. A., Sales Metallurgist, Bethlehem Steel, Bethlehem, Pa.
White, W. O., Div. Engr., C. & E. I. R. R., Salem, Ill.
Wilbur, R. H., V. P. & G. M., L. & N. E., Philadelphia, Pa.
Woemer, Albert H., Wheeling, W. Va.
Zimmerling, R. O., Field Engr., Universal Portland Cement Co., Chicago.

## St. Paul Sectional Committee Meeting

The next meeting of the St. Paul Sectional Committee of the Signal division will be held in the Railroad Building, St. Paul, Minn., on Saturday, March 20, beginning at 9 a. m. The subjects to be presented before the meeting include The Use and Misuse of Roundels and Lenses, with stereopticon views, by Dr. Gage of the Corning Glass Company; A Close-up Study of Primary Batteries, by L. S. Dunham of Thos. A. Edison, Inc.; Mixing and Handling of Concrete, by E. M. Hatheway of the Massey Concrete Products Corporation, and Insulated Wire and Cable in Signal Service, by Major Axel Ames of the Kerite Insulated Wire & Cable Company.

## The Railways Will Receive Preference

THE MANUFACTURERS REALIZE fully the vital necessity for a thoroughly effective railway transportation system in this country and are, therefore, more than willing to give the roads preference in orders for the materials and supplies which they require. This was the opinion expressed by F. A. Poor, president of the P. & M. Co., when interviewed at his office yesterday afternoon. "I also believe," he added, "that the railway supply companies will be able to provide production to meet the heavy demands which are expected, although deliveries will be slow and prices high. I think it will be found that the large steel companies and the large malleable iron foundries will be glad to give orders for railway equipment precedence over other orders they may have on hand, even against great pressure from their old customers."

When asked as to the effect of diverting many of the plants to war work and later to other lines of manufacture, he said that he did not believe that this would seriously affect the ability of the manufacturers to meet all demands made on them. "Some of the companies," he said, "were obliged to take up other lines because of the failure of the roads to keep them busy. The manufacturers are ready to take up railway work as fast as the roads offer it."

The production of railway supplies naturally divides itself into two groups, that concerned with equipment and that engaged in the production of rails and track accessories. Mr. Poor is of the opinion that there is ample plant capacity in this country to fill all orders for the production of rails in whatever quantity the railroads are able to finance or they are able to organize their forces to use. Some question arises, of course, as to the supply of basic materials in the lines requiring materials in large quantities. The railroads, however, are sure to obtain a preference for whatever supplies are available. In the field of track accessories, the problem of raw material is much simpler and the manufacturers are well able to take care of the roads. Foreign business as developed thus far or in prospect for the immediate future will have little or no influence on the situation. There is no occasion for any concern on this score.

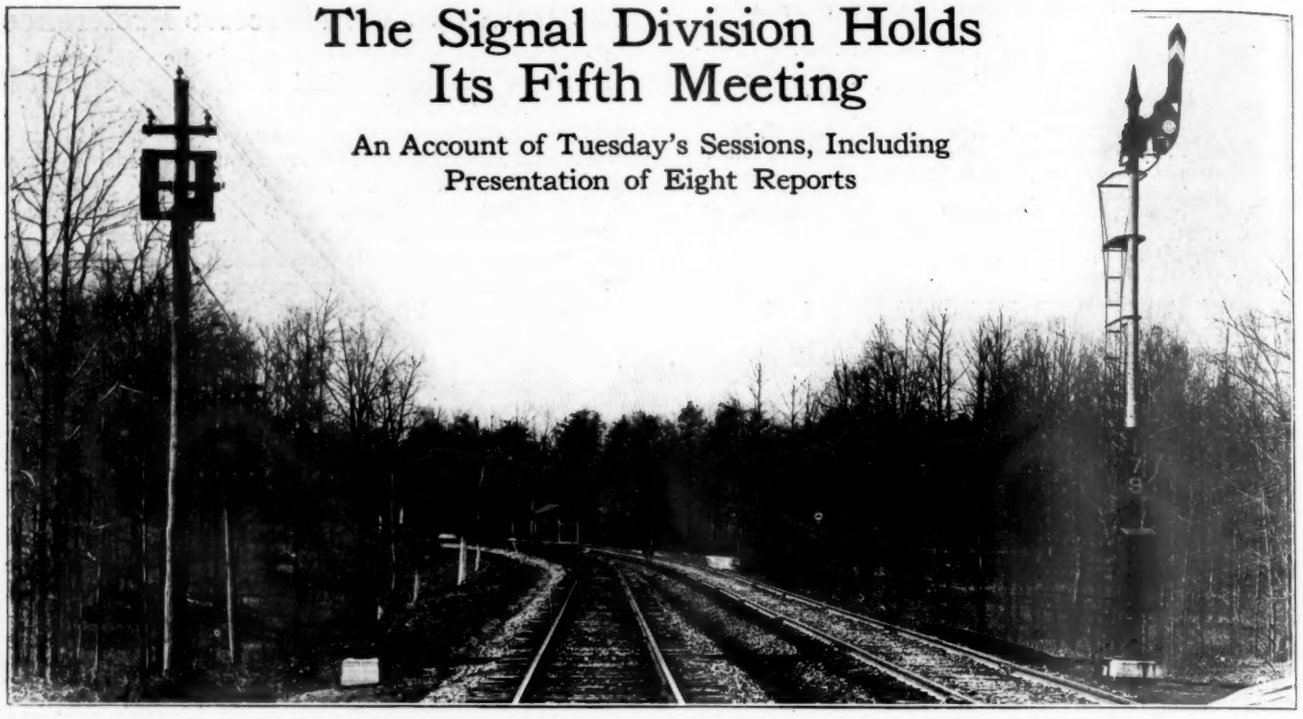
"Naturally, the sooner the railways come into the market the earlier their wants will be filled. If the railways could make up a definite program of their requirements for a term of years so that the manufacturers could plan ahead their production program, there is no doubt but that more definite promises of delivery could be made and prices would undoubtedly be lower."

## Pennsylvania Lines Signalmen Have Banquet

A dinner of the signal department officers of the Pennsylvania Railroad was held in the Green Room, Congress Hotel, on Monday evening. Among those present were A. H. Rudd, chief signal engineer; F. H. Buchanan, assistant chief signal engineer; G. A. Cellar, superintendent telegraph; C. W. Hixson, superintendent telegraph and signals, Northwestern region, Pennsylvania Railroad; W. N. Spangler, superintendent of telegraph and signals, Eastern district; W. M. Post, superintendent telegraph and signals, Central district; Thomas Holt, signal engineer, Chicago Union Depot Company, and signal supervisors and inspectors from various parts of the system. Approximately 50 were in attendance at the meeting, Mr. Rudd acting as toastmaster. Among those speaking were Mr. Cellar, Mr. Holt, Mr. Buchanan and Mr. Hixson. This meeting was a get-together meeting in order that the various signal officers of the reorganized system could become better acquainted.

# The Signal Division Holds Its Fifth Meeting

## An Account of Tuesday's Sessions, Including Presentation of Eight Reports



THE SECOND DAY'S SESSION of the stated meeting of the Signal division was called to order at 9:45 a. m. by Chairman C. J. Kelloway. The room was well filled throughout the day, considering the fact that the opening meeting of the A. R. E. A. and a meeting of the American Railroad Signal Supervisory Association drew some of the members of the Signal division to either one or the other of these meetings. Reports were presented by the committees on Batteries, Electrical Testing, Direct Current Relays, Power Interlocking, Wires and Cables, A. C. Automatic Block Signaling, D. C. Automatic Block Signaling and Contacts. Committee V—Maintenance Rules and Instructions did not submit its report to the division, as the work which had been accomplished since the last meeting was to be presented for discussion only. Due to the amount of time consumed on Monday in the discussion of its future status, but four committees out of the eight on the program for Monday's session were able to submit reports. As a consequence, four of the committee reports scheduled for Monday had to be presented at yesterday's meeting. As Committee V was next to the last on the program yesterday and as the report was to be submitted for discussion only, it was the sense of the committee that it would prefer to continue its work with a view of presenting the entire subject at the annual meeting at the Thousand Island Hotel, Alexandria Bay, N. Y., July 14, 15 and 16, and thus conserve the time of the division.

In addition to the reports mentioned, a verbal report was presented by Committee No. 17, Pole Lines, in which Chairman John Leisenring said:

"A matter has come up somewhat unexpectedly that warrants the attention and action of this committee. As you all know, the Bureau of Standards about two or three years ago issued a proposed Safety Code governing the construction and maintenance of outside plant and electrical apparatus. During the past two years the Bureau has been revising that original code, weakening the original specifications to some extent, and considerable criticism has been raised by the railways on that account. The Committee on Electricity of the American Railway Engineering Association has dealt with the Bureau on the question of high tension wire crossings over railways.

"The particular matter we wish to bring before the meeting is the proposed revision by the Bureau of the specifications for signal line crossings over steam railways.

"I want to point out that the use of the word 'signal lines' refers primarily to communication circuits. The matter is not of vital importance to this association, but is to the railroads as a whole. The Telegraph and Telephone division of the A. R. A. has considered this subject in detail and has made certain recommendations.

"The two most vital points that the Bureau intends to revise downward are the questions of wire crossings over side tracks and reducing their previous specifications materially, and the question of transverse loading. On account of the necessity for quick action we wish to have this association go on record as supporting the Telegraph and Telephone division in their report to the Bureau of Standards on this particular subject."

The committee made a motion that the association support the recommendations of the Telegraph and Telepone division of the A. R. A.

In this connection T. S. Stevens (A. T. & S. F.) said that "we are not an association, but a division of Engineering Section No. 2. I read over the specifications which are being submitted by the Engineering Section, the old A. R. E. A., and don't know whether they comply with the specifications of the Telephone and Telegraph division, but I don't believe we can take any action on this matter at this time."

A. H. Rudd (P. R. R.) felt that the division could not endorse it unless the matter was considered more carefully, as he understood that there is some difference of opinion in the other divisions in regard to the matter under discussion. He then moved that the motion be laid on the table. (Motion carried.)

Before adjournment T. S. Stevens (A. T. & S. F.) made a motion which was seconded and carried unanimously that the division send a message of congratulation to all of the Sectional committees, thanking them for the good work being accomplished by them.

# Report of Committee VII—Direct Current Relays

THE OUTLINE OF work assigned to the committee was as follows: (1) Prepare specifications for relays. (2) Prepare resistance table for relays. (3) Recommend minimum drop-away for relays listed in resistance table. (4) Prepare specification for relay parts providing for interchangeability.

The committee submitted for consideration specification for tractive armature direct current relays as follows:

## 1. DESIGN

(a) Relays shall be of a design approved by the purchaser. 1920.

(b) All moving parts shall be inclosed in a dust-proof case, the sides of which shall be of glass of such transparency that the parts within the case shall be visible for inspection. 1920.

(c) A screened breather opening, in base of case, adaptable for closing, shall be provided. 1920.

(d) All nuts and screws shall be securely locked. 1920.

(e) Unless otherwise specified, the outside dimensions of completed relay shall not exceed the following:

| | 2 to 4 Fingers | 6 Fingers | 8 Fingers |
|---|---|---|---|
| Height, | 9½-in. | 9½-in. | 9½-in. |
| Length,* | 7½-in. | 10 -in. | 12½-in. |
| Width,* | 7½-in. | 7½-in. | 7½-in. |

1920.

## 2. MOUNTING

(a) Parts shall be mounted on a top plate. 1920.

(b) This top plate shall be of non-conductive, non-carbonizing material. 1920.

(c) The cores and armature supports shall be mounted in such a manner that the position of the cores relative to each other, to the armature supports and to the fixed part of the contracts shall be maintained. 1920.

## 3. ARMATURE SUPPORTS

(a) The end play of the armature shall be not less than .010 in. and not more than .020 in. 1920.

(b) Trunnions and bearings for armature shall fit rigidly in their supports and be suitably secured and so constructed that they cannot exert pressure on the armature. 1920.

(c) Armature trunnions shall be hard-drawn phosphor bronze. They shall be cylindrical, not less than 1/16 in. in diameter and 3/32 in. long. 1920.

(d) The armature bearings shall be of different material than the trunnion, either hard brass or nickel-silver, not less than 18 per cent. nickel, or of material equivalent in wearing and non-corrosive qualities. They shall be cylindrical, not less than ⅛ in. long and not less than .002 in. nor more than .004 in. larger in diameter than the trunnion. 1920.

## 4. AIR GAP

(a) A minimum working magnetic air gap of .020 in. for a relay of one or two points, and of .015 in. for a relay of three or more points shall be maintained by an adjustable hard phosphor bronze stop pin so placed that its position relative to the cores shall be fixed and so that when the armature is picked up it will strike against the stop near the edge farthest from the bearing and midway between the cores. The physical working air gap shall be not less than .018 in. for a one or two point relay and .013 in. for a three or more point relay. 1920.

(b) A non-adjustable stop-pin of phosphor bronze shall be placed under each core near the edge farthest from the bearing protruding .010 in. from the under side of the core or the upper side of the armature for safety purposes. 1920.

## 5. COILS

(a) Coils shall be so made that they may be removed and replaced without changing the magnetic and mechanical adjustment of the relay. When in place the coils shall be fixed to prevent their movement by vibration with respect to the cores. 1920.

(b Coils shall be so insulated that they will withstand the insulation test provided in Section 9. This test shall be made by making coil on a snugly fit metal mandrel and making break-down test between mandrel and winding; also, by standing coil on each end in turn on a metal plate and testing between plate and winding. 1920.

(c) Wire for coils shall be soft drawn copper, covered with good quality silk or cotton insulation, or with equally good insulation. 1920.

(d) Coils shall be impregnated or otherwise treated so as to satisfactorily protect the wire from moisture under all service conditions. Impregnation shall be in accordance with R.S.A. specifications for "Impregnation Treatment of Coils and Windings." 1920.

(e) Connecting terminals of coils shall be joined by R.S.A. binding post. The terminal leads of coils shall be composed of a number of strands of tinned copper, no strand to be larger than .012 in. There shall be enough strands to aggregate the cross section of No. 18 A.W.G. wire. Leads shall be insulated to withstand ground test as provided in Section 9. 1920.

(f) Coils shall be protected in a suitable manner from mechanical injury. 1920.

(g) At 20 degrees C. (68 degrees F.) the percentage variation in the resistance of individual coils shall be as follows:

For 5 ohms or less, plus or minus, 5 per cent.

Above five ohms, plus or minus, 10 per cent. 1920.

(h) Each coil shall be plainly and permanently marked, showing the nominal resistance, number of turns, size of wire and kind of wire insulation on a tag located under the outside lead. 1920.

(i) All coils must be full wound and the turns must not be permitted to vary more than five per cent, plus or minus, for any given coil. If a resistance is specified which cannot be obtained with standard A.W.G. wire, using full wound coils, the Manufacturer may furnish the nearest resistance to this value, using full wound coils with standard A.W.G. wire. 1920.

## 6. CONTACTS

(a) For contacts of the carbon to metal type, a front contact shall be comprised of two elements so designed and of such materials that the contact surfaces cannot be fused together nor mechanically locked by lightning, or by an abnormal flow of current in the service for which the contact is designed. Elements shall be secured so that they will not shift or become loose in service. Any materials used in affixing contact elements must not cause corrosion. The metal support of the non-flexible contact element shall not come within 1/16 in. of the contact surface. 1920.

(b) For contacts of the carbon to metal type, the front contacts shall not in 100,000 operations (when operating 10 times per min.) average more than .3 ohm per contact when the relay is energized at "operating volts," and when not breaking current or when current broken by the contacts does not exceed 20 milamperes through an inductance of the equivalent to a 500 ohm slow acting slot coil. The contact resistance shall be determined by taking at least 20 readings on each contact of the relay at intervals of 5,000 operations during the test. The contact resistance shall be the average of all readings. The initial cleaned contact resistance shall not exceed .18 ohms per contact when relay is energized at "operation volts." Each contact shall be designed to carry 3 amperes continuously and 5 amperes for 30 sec. without injurious heating. 1920.

(c) For contacts of the carbon to carbon type, the front contacts shall not in 100,000 operations (when operating 10 times per min.) average more than 3 ohms per contact when relay is energized at "operating volts" and when not breaking current or when current broken by the contact does not exceed 30 milamperes through an inductance of the equivalent to a 3500 ohms slow acting slot coil. The initial cleaned

*The length is the dimension parallel with the armature, and width is the dimension parallel with the contact fingers.

contact resistance shall not exceed 4 ohms per contact when the relay is energized at "operating volts." Each contact shall be designed to carry 3 amperes continuously without injurious heating. 1920.

(d) For contacts of the metal to metal type, the initial cleaned contact resistance shall not exceed 3 ohms per contact. Each contact shall be designed to carry not more than 3 amperes continuously and 5 amperes for 30 sec. without injurious heating. 1920.

(e) Contact fingers shall be made of such material and so proportioned that they will not flex appreciably under operating conditions. 1920.

(f) A device shall be provided to lock the armature rigid with all contacts open during shipment. 1920.

Sections:—7. Flexible connections; 8. Bending posts; 9. De-electric requirements; 10. Magnetic iron test; and 11. Armature torque. Each of these sections are the same as 1912 specification.

### 12. Adjustment

(a) Relays shall be adjusted so that when tested in the manner given below the operating current values and contact opening shall be as follows:

1. For relays with four ohm coils and contacts carrying first range voltage:

| | Relays With Two Fingers | Relays With Four Fingers |
|---|---|---|
| Minimum drop-away with contact pressure | 0.35 amp. | .037 amp. |
| Maximum pick up | .072 amp. | .078 amp. |
| Maximum working current | .078 amp. | .092 amp. |
| Front contact opening | .050 in. | .050 in. |
| Back contact opening | .020 in. | .020 in. |

1920.

(b) Tests; (c) Drop-away with contact pressure; (d) Maximum pick up; and (e) Working current, are 1912 specification.

### 13. Finish

(a) Metal parts shall be protected against corrosion, except when such protection will interfere with the proper operation of the relay. 1920.

(b) Material used for protection against corrosion shall neither melt nor flake under ordinary conditions between temperatures of 40 degrees C. (40 degrees F.) below zero, and 85 degrees C. (185 degrees F.) above zero. 1920.

Sections:—14. Material and workmanship, 1911 specification. 15. Inspection; 16. Tests; and 17. Packing are standard sections. 1919.

### 18. Marking

(a) Purchaser's order, requisition and package number, name of consignor, and name and address of consignee, shall be plainly marked on outside of package. 1920.

The committee recommended the acceptance of this specification for submission to letter ballot at the annual meeting for inclusion in the Manual.

Committee: E. G. Stradling (C. I. & L.), chairman; C. D. Cronk (N. Y. C.), vice-chairman; C. M. Acker (D. & H.), E. T. Ambach (B. & O.), B. H. Ayers (L. & N.), C. W. Burrows, D. M. Case (Sou. Lines West), E. F. Champlin (Erie), J. J. Corcoran (N. Y. C.), A. R. Fugina (L. & N.), E. W. Kolb (B. R. & P.), H. W. Lewis (L. V.), C. F. Smith (U. P.), C. F. Stoltz (C. C. C. & St. L.), Guy Toft (P. R. R.), C. A. Veale (S. P.), W. B. Weatherbee (D. L. & W.).

## Discussion

B. T. Anderson (D. L. & W.): I believe the title of this specification should be changed to refer to the four ohm relay, because the specification only covers that.

E. G. S. Stradling (Chairman): So far we have only the figures for the four ohm relay, but at the annual meeting we hope to have a table showing the characteristics of the various relays in general use.

E. B. Smith (N. Y. C.): As I understand it, No. 2 (b) does not permit the use of the Bakolite top or the the metal top, and I would like to know why the committee barred those.

Mr. Stradling: The committee feels that the top should be of non-conductive material, which would bar the metal top and I understand the Bakolite will carbonize under lightning strain.

H. G. Morgan (I. C.): The Illinois Central has in service between 8,000 and 10,000 relays with Bakolite tops, and has not had any trouble.

J. A. Peabody (C. & N. W.): I think the committee should cut out "non-conductive." We have a good many thousand metal top relays, and I much prefer them to the other types. In order to get this before the meeting I move that the words "non-conductive" be cut out.

(Motion seconded and lost.)

W. H. Elliott (N. Y. C.): Under 5 (e) I suggest that the second and third sentences be reworded so as to read: The terminal leads of coils shall be of strands of tinned copper, not larger than 0.012 in. The aggregate cross-section of the strands shall equal that of No. 18 A.W.G. wire.

C. S. Snavely (U. S. & S. Co.): I suggest paragraph 5 (b) be changed, as follows: Coils shall be so insulated that under conditions equivalent to being placed on the relay, they shall withstand an insulation test of 3,000 volts for a period of 2 sec.

Mr. Elliott: I suggest the following modification of the first sentence of 6 (a): Contacts of the carbon to metal type shall be so designed and of such material that the contact surfaces cannot be fused together by lightning or an abnormal flow of current or mechanically.

Mr. Snavely: In 6 (b) the contact resistance was agreed to under the assumption that a higher contact pressure should be provided than is the general practice. In order to provide this a higher recommended working value is necessary. That means that the contact resistance, the calibration value and the recommended working value do not check up.

P. E. Carter (G. R. S. Co.): At the various meetings of the committee the manufacturers went into considerable detail as to what they felt they were able to do in the way of guaranteeing contact resistance. If we run around these critical applications of pressure, with a good grade of contact material, the resistance of the contact can be kept fairly uniform over a very long number of operations. We also find we can keep the value of the resistance practically the same whether the contact is breaking current or not. Paragraph 6 (b) was outlined from that stand.

E. W. Kolb (B. R. & P.): If enough pressure is put on the contact a satisfactory resistance will be obtained. On the other hand, a low pressure will give an erratic resistance. Where the committee and the manufacturers did not agree was on what contact pressure we could allow them. When the contact pressure is decided, the resistance, the working current and a great many other values in the specifications for the relays will be settled.

R. M. Phinney (C. & N. W.): Recently in making tests I have found that our result was entirely different from the manufacturer's. In testing, we reduce the current to a certain minimum, but do not open the circuit; they open the circuit.

B. T. Anderson (D. L. & W.): The committee has left out the standard clause on warranty.

Mr. Stradling: It will be incorporated in the report for the annual meeting. I move that this be submitted at the annual meeting for approval and ballot. (Motion seconded.)

C. H. Morrison (N. Y. N. H. & H.): Do I understand the motion is putting this specification up as a four ohm relay specification, or is it the intention of the committee to submit completed specification covering other than four ohm relays at the annual meeting?

Mr. Stradling: It is the intention of the committee to submit to the annual meeting this specification with a table covering the relays which we find generally used.

(Motion carried.)

The committee was dismissed with the thanks of the association.

# Report of Committee IV—D. C. Automatic Block Signaling

THE FOLLOWING outline of work was assigned this committee:

(1) Prepare specification for:

(a) Motor-operated signal mechanism for first range voltage, including:

(1) Allowable variations in energy to operate and hold signal. (2) Allowable variation of torque in foot pounds to restore mechanism with spectacle to stop position. (3) Allowable variation of torque in foot pounds to restore mechanism with spectacle and arm to stop position.

(b) Signal installations.

(c) Rail bonding and track circuits.

(d) Resistance units.

(e) Switch circuit controllers for automatic signaling.

(2) Prepare instructions for making torque tests of power-operated signals.

(3) Revise specifications for channel pins.

(4) Report on the effect of the use of zinc-treated ties upon the efficient operation of the track circuit.

The committee submitted specification for motor-operated high signal mechanism for first range voltages.

## Specification for Direct Current Motor-Operated First Range Voltage High Signal Mechanism

Sections 1, the **requisite sheet**, and 2, the **tender**, cover standard sections (S. S. 4-a), (S. S. 4-b) and (S. S. 3-a), 1919.

### 3. General Requirements

(a) Mechanism cases shall be provided with openings for ventilation. Each opening shall be provided with a screen and protected with a hood. Opening shall be provided with a cover for adjustment of ventilation. 1920.

(b) Mechanism shall be designed so that the failure of any part to properly perform its function shall cause semaphore to assume its most restrictive indication. 1920.

(c) Mechanism shall be so arranged that all parts are readily accessible for inspection or removal. 1920.

(d) Like parts of mechanisms of the same type and manufacture shall be interchangeable. 1920.

(e) Side clamp mechanism and mechanism cases shall be so designed that when clamped in place on signal mast they will not interfere with the indication of semaphore arm or lights as viewed from approaching trains. 1920.

(f) Spectacle clearances between lamp or other rigid parts shall be in accordance with R. S. A. 1093. 1920.

(g) Movement of semaphore arm shall be so controlled as to prevent any undue shock upon mechanism. Semaphore arm shall travel through full arc to the restrictive position in not more than six seconds. 1920.

(h) The torque applied at semaphore shaft, with spectacle removed, necessary to start that part of mechanism connected thereto from any position in its arc of travel, shall not exceed maximum mechanism friction shown on R.S.A. 1064. 1920.

(i) With the mechanism complete and the semaphore in place, the difference between the torque required to hold the semaphore arm in any position of its arc of travel and the torque of the semaphore and blade shall not be more than two foot pounds greater than the maximum mechanism friction torque shown on R.S.A. 1064. 1920.

(j) With a counter-torque of 20½ ft. lb. applied at semaphore shaft and with spectacle and blade in place, the signal shall start toward the stop position from any point of its arc of travel. 1920.

(k) The torque in foot pounds of all signal blades shall be in accordance with R.S.A. 1064. 1920.

(l) Semaphore spectacle shall be in accordance with R.S.A. 1040 and 1041. 1920.

(m) Means shall be provided for attaching testing apparatus for making torque test of semaphore shaft in the field. 1920.

(n) The adjustment of contracts, and arrangement of circuits governing signal motors and holding coils shall be such as to cause the semaphore to display true indications corresponding with the position of the controlling relays or levers. 1920.

(o) Mechanism shall be equipped with counters of approved type reading to five digits to record movement of 45 degree and 90 degree positions of signal as specified on requisite sheet. 1920.

### 4. Mechanism Case

(a) Mechanism case shall be of iron, weather-proof, and of ample size to properly house, without crowding, the apparatus and wiring contained therein. Doors shall be suitably arranged for convenient and ready access to mechanism. 1920.

(b) Convenient means shall be provided for bringing electrical connection from pole to mechanism case, and for making a good mechanical connection where wires enter case. 1920.

(c) Housing for base of mast mechanism shall have doors as specified on requisite sheet. 1920.

(d) Hasp with staple shall be provided for rigidly securing and locking doors of mechanism case. 1920.

(e) Side clamp mechanism case shall be provided with an eye bolt in top of case for convenience in handling. 1920.

(f) Conduit of flexible type shall be provided for protection of wires entering mechanism case of the side clamp type. Conduit shall be not less than two inches inside diameter, and furnished with means for making connection to mast and case. Wire entrance shall be readily accessible for sealing and have edges rounded to prevent fracture of wire. 1920.

(g) An opening of eight square inches area shall be provided in base of mast mechanism case for entrance of wires. 1920.

(h) Spacing of bolt holes for fastening base of mast mechanism case to foundation shall be in accordance with R.S.A. 1259. 1920.

(i) Two openings in top of case, one on each side of mast for 1¼-in. inside diameter pipe, shall be provided in base of mast mechanism case. Openings shall be equipped with pipe plugs. Condulet for cable outlet with pipe shall be furnished when specified on requisite sheet. 1920.

(j) Each section of base of mast mechanism case shall have four openings for ventilation, two in each end of the case. Openings shall have an area of not less than 10 sq. in. and be covered with a screen of number 31 gage brass or copper wire, 40 wires per in. The hood shall extend at least one inch below the lower edge of the opening into the mechanism case, and the area of the opening at the lower side of the hood shall be at least 60 per cent of the area of the opening into the case. 1920.

(k) Side clamp mechanism cases shall have two openings for ventilation, one near the top and one at the bottom. Openings shall have an area of not less than 1½ sq. in. Openings shall be covered with a screen of number 31 A.W.G. brass or copper wire, 40 wires per in. 1920.

(l) Cases for base of mast mechanism shall be of sufficient mechanical strength to support signal mast specified on requisite sheet and shall have four ⅞-in. stud bolts, with nuts and washers on both ends, properly centered for fastening signal mast to mechanism case. 1920.

### 5. Operating Connection—Mechanism at Base of Mast

(a) Operating connection of the pull clear type shall have a tensile strength of not less than 1,500 lb. Material shall be such as will not be injuriously affected by atmospheric conditions. Suitable connections shall be provided at each end, the lower one of which shall have means of adjustment. 1920.

(b) Operating connection of push clear type shall be ¾-in. iron pipe or its equivalent in mechanical strength; material used shall be such as will not be injuriously affected by atmospheric conditions. Connectors shall be provided at each end, the lower one of which shall have means for adjustment. Guides, when specified on requisite sheet, shall be securely fastened to mast by three set screws. 1920.

### 6. Bearings

(a) Bearings shall be of ample dimensions, and of such material and design as will insure reasonable durability and the reduction of friction to a minimum. 1920.

(b) Accessible means shall be provided for lubrication of bearing surfaces. 1920.
(c) Semaphore bearings shall be so constructed as to prevent entrance of water. 1920.
(d) Exposed oil holes shall be provided with weather-proof oil cups or covers. 1920.
(e) The diameter of outer end of boss of semaphore bearings shall be not more than 1¼ in. larger than outside diameter of bearing. 1920.
(f) Hand hole with weather-proof cover shall be provided in housing of semaphore bearings for base of mast mechanism. Cover shall be secured to pole by a chain or other means to prevent dropping. 1920.

### 7. Semaphore Shaft

(a) Semaphore shaft shall be made of steel, not less than 1 in. sq. or 1¼ in. diameter round, except the outer end, which shall take spectacle R.S.A. 1040 unless otherwise specified on requisite sheet. 1920.
(b) The operating means shall be mounted on a square portion of the shaft or otherwise rigidly connected thereto. 1920.

### 8. Gears

(a) Gears shall be of such material and design as to insure against undue wear or breakage and have ample clearance to prevent sticking or jamming. 1920.
(b) Gears shall be so protected as to minimize the likelihood of foreign matter interfering with them. 1920.
(c) Means shall be provided in signals of drive back type, to prevent undue strain being transmitted to gears or motor. 1920.

### 9. Mechanism Frame

(a) Mechanism frame shall be of ample dimensions and of such material as will insure reasonable durability. 1920.

### 10. Terminal Board

(a) Terminal board shall be made of suitable material, not affected by ordinary temperature or changes of atmospheric conditions, not less than ½ in. thick or as specified on requisite sheet. 1920.
(b) Terminal board shall be located so as to be easily accessible. 1920.

### 11. Wiring

(a) Wiring shall be neatly arranged and securely fastened. 1920.
(b) Flexible insulated copper wire not smaller than No. 16 A.W.G. and not less than 19 strands shall be used for interior wiring of signal case. 1920.
(c) Wires shall be provided with eyelets at each end. 1920.
(d) Diagram showing the wiring of mechanism shall be pasted on the inner side of door of mechanism case. 1920.

### 12. Motor

(a) Motor shall operate at the rated voltage specified on requisite sheet. 1920.
(b) Motor shall start the semaphore from any point in its arc of travel with 60-ft. lb. torque, and rated voltage at the motor terminals. 1920.
(c) With a torque on semaphore shaft, as shown by curve "A," R.S.A. 1064, and with normal rated voltage applied at the motor terminals, the maximum energy required to move the semaphore arm from the zero degree position to the ninety degree position shall be not more than 300 watt sec. 1920.
(d) Motor shall start the semaphore with 45-ft. lb. torque from any point in its arc of travel, when a voltage of 40 per cent under normal is impressed on the motor terminals. 1920.
(e) Motor and mechanism of drive back type shall start toward the restrictive position when voltage impressed on motor terminals is reduced to 50 per cent of the minimum required to start it toward the proceed position, when semaphore torque is 45-ft. lb. 1920.
(f) Motor cover shall be so designed that when closed foreign matter cannot enter. 1920.
(g) All moving parts except bearings and contacts in the assembled motor of the drive back type of mechanism shall be separated by not less than .025 in. The minimum end play of moving parts shall be .010 in. 1920.
(h) Brush holder shall be designed to maintain practically constant brush pressure on commutator during life of brush. In signals of drive back type, brush holder support shall be non-adjustable and shall prevent brush holder from coming in contact with motor commutator. 1920.
(i) Means shall be provided to insure the proper setting of motor mechanism of drive back type to prevent binding. 1920.

### 13. Hold Clear Device

(a) With a torque on a semaphore shaft as shown by curve "A," R.S.A. 1064, the hold clear device shall hold mechanism in the 45 or 90 degree position when a voltage of 40 per cent under normal is applied at its terminals. 1920.
(b) The hold clear device shall be so constructed that it will release and allow the mechanism to assume its restrictive position when a voltage of 25 per cent of rated is impressed upon the terminals of quick acting hold clear windings, or when a voltage of 18 per cent of rated is impressed upon the terminals of slow acting hold clear windings, the semaphore torque in either case being as shown by curve "A," R.S.A. 1064. 1920.
(c) Hold clear device of the magnet type shall have an air gap between armature and magnet cores, of not less than .015 in., maintained by positive and durable stops. The construction shall be such that there will be no undue accumulation of lubricating oil, dirt, or rust in the air gap. Magnet coils shall be so applied and connected that they can be easily replaced. 1920.
(d) With the semaphore and blade in place and the electro-magnet coils of the hold clear device deenergized, it shall require a force of not less than 1½ lb. applied at the center of the armature to hold mechanism in any position above zero when the air gap is .015 in. The force required with other air gaps may vary inversely as the square of the air gap. 1920.
(e) Wire leads to magnet coils shall be insulated flexible copper not smaller than No. 18 A.W.G. and not less than 19 strands. 1920.
(f) To prevent mechanical injury to wire, magnet coils shall be suitably protected by tape or other covering. 1920.
(g) Hold clear coils shall be form or spool wound and securely fastened in place to prevent vibration. 1920.
(h) A suitable label shall be securely fastened to the surface of each magnet coil, on which shall be legibly and indelibly stamped the resistance, size of wire with which the coil is wound and manufacturer's reference number. 1920.
(i) With a torque on semaphore shaft as shown by curve "A," R.S.A. 1064, and with rated voltage, the power required to hold mechanism in the 45 or 90 degree position, shall not exceed .2 watts when the air gap is .015 in. For greater air gap a corresponding increase in power is permissible. 1920.

### 14. Circuit Controller

(a) Connection between semaphore shaft and circuit controller shall be positive and of such design as to prevent binding or undue friction in the operation of parts. 1920.
(b) Contacts shall be applied in a manner which will preclude the possibility of their jamming, butting against moving parts, or causing undue friction. 1920.
(c) Contacts shall be of non-corrosive material, of high conductivity, easily accessible, and separately adjustable. They shall be self-cleaning and mechanically forced to the required position by the movement of shaft. 1920.
(d) Pole changer and other contacts for the control of track circuits shall be silver to silver. 1920.
(e) In addition to the regular contacts for controlling the signal motor and hold clear device, the circuit controller shall be equipped with contacts for controlling external circuits, as specified on requisite sheet. 1918.

### 15. Binding Posts

(a) Binding posts shall be in accordance with R.S.A. 1070. 1920.

### 16. Insulation

Paragraphs (a) and (b) refer to general electrical requirements (G.E.R. 32a), 1919, and (G.E.R. 32-b), 1917.
(a) Coils and windings shall be of cotton or silk-covered wire impregnated; of enameled wire, or as shown on requisite sheet. Enameling or impregnation shall be in accordance with R.S.A. specifications. (G.E.R. 32-a.) 1919.
(b) Material used for insulation shall be such as will not be seriously affected by atmospheric conditions. (G.E.R. 32-b.) 1917.
(c) Insulating material used as a base or support or where subjected to mechanical strain, shall have sufficient strength to properly perform its function, and shall not easily carbonize when subjected to an arc over. 1920.

### 17. Finish

(a) Metal parts shall be protected against corrosion, except where such protection will interfere with the proper functioning of that part. 1920.
(b) Material used for protection against corrosion shall neither melt nor flake off under ordinary conditions between temperatures of forty (40) degrees Centigrade below zero

(40° F.) and eighty-five (85°) degrees Centigrade above zero (185° F.). 1920.

Sections on the dielectric requirements, tests, inspection, packing, marking and warranty are covered in general electrical requirements and standard sections, 1919.

Committee: C. F. Stoltz (C. C. C. & St. L.), chairman; G. H. Dryden (B. & O.), vice-chairman; R. B. Arnold (C. & N. W.), F. H. Bagley (L. & N.), M. A. Baird (Erie), H. L. Black (G. T.), E. E. Bradley (W. M.), J. H. Butridge (I. C.), T. N. Charles (Sou. Lines West), A. H. Dahlstrom (U. P.), R. E. Green (M. C.), E. Hanson (G. C. & S. F.), C. E. Hartvig (C. R. I. & P.), T. A. Jones (P. R. R.), G. A Kirley (B & A.), B. A. Lundy, H. H. Orr (C. & E. I.), E. B. Pry (P. L. W.), A. Reilly (D. L. & W.), G. W. Trout (P. M.), E. P. Weatherby (T. & P.), E. E. Worthing (S. P.).

### Discussion

J. E. Stephenson (G. R. S. Co.): Paragraph 3 (b) is a physical impossibility.

Mr. Stoltz: The committee had "when practical" or "when possible," or a few other such phrases; these meant nothing to the committee, so it left 3 (b) as written. In the last line of (g) the time has been changed to read eight seconds.

Paragraph 11 (b) has been changed to read "Not less than 16 strands" instead of 19 strands as printed. We find that a satisfactory wire is being furnished in 16 strands. 13 (e). Here also, the number of strands has been changed from 19 to 16.

I move the approval of the report for submission to the annual meeting for submission to letter ballot for inclusion in the Manual.

(Motion seconded and carried.)

The committee was dismissed with the thanks of the association.

# Report of Committee XII—Contracts

THE FOLLOWING outline of work was assigned to this committee:

1. Prepare standard form of contract for installation of interlocking plans and block signaling.

The committee submitted for consideration a report on this assignment.

### Form of Contract for Block Signal and Interlocking Work

THIS AGREEMENT, made this ..... day of .....in the year ..... by and between ....., party of the first part, hereinafter called the Contractor, and ....., party of the second part, hereinafter called the "Company":

WITNESSETH, That, in consideration of the covenants and agreements hereinafter mentioned, to be performed by the parties hereto, and of the payments hereinafter agreed to be made, it is mutually agreed as follows:

The Contractor shall furnish all materials, superintendence, labor, equipment and transportation, except as hereinafter specified, and shall execute, construct and finish in an expeditious, substantial and workmanlike manner, to the satisfaction and acceptance of the Signal Engineer of the company, hereinafter called the "Engineer" .....

.....

.....

The work covered by this contract shall be commenced within ..... days after the execution of this contract and shall be completed on or befort the ..... day of ....., 19....

And in consideration of the completion of the work described herein, and the fulfillment of all stipulations of this agreement to the satisfaction and acceptance of the Engineer of the Company, the said Company shall pay, or cause to be paid, to said Contractor, the amount due to the Contractor, based on the following prices:

.....

#### 1. Bond

At the option of the Company, the Contractor agrees, at the time of the execution and delivery of this contract and before the taking effect of the same, to furnish and deliver to the Company a good and sufficient bond of indemnity to the amount of ..... dollars, as security for the faithful performance, by the Contractor, of all covenants and agreements on the part of the Contractor contained in this contract. The security in such bond of indemnity must be satisfactory and acceptable to the Company.

#### 2. Understanding of Contract and Plans and Specifications

The Contractor hereby distinctly and expressly declares and acknowledges that, before the signing of this contract, he has carefully read the same, and the whole thereof, together with and in connection with said plans and specifications, and that he has made such examination of this contract and of said plans and specifications, and such investition of the work required to be done, and in regard to the material required to be furnished, as to enable him to thoroughly understand the intention of the same, and the requirements, covenants, agreements, stipulations and restrictions contained in this contract and in said plans and specifications, and distinctly agrees that he will not hereafter make any claim or demand upon the Company, based upon or arising out of any alleged misunderstanding or misconception on his part of the said requirements, as covered by said contract and plans and specifications. 1920.

#### 3. Plans and Specifications

The work to be done is more fully described in the specifications dated ..... and the following plans:

.....

.....

.....

which specifications and plans are hereto attached and are hereby declared to be, and are accepted, as a part of this contract.

Work that may be called for in the specifications but not shown on the plans, or shown on the plans and not called for in the specifications, or which is obviously necessary to properly comply with the plans and specifications, shall be furnished and performed the same as if specifically shown or mentioned in both. 1920.

#### 4. Rights of Various Interests

Wherever work being done by Company forces or by other contractors is contiguous to the work covered by the contract, the respective rights of the various interests involved shall be established by the Engineer, to secure the completion of the various portions of the work in general harmony. 1920.

#### 5. Consent to Transfer

The Contractor shall not transfer this contract, nor sublet any part of the work except as to the purchase of material, without the written consent of the Engineer, and such consent shall not relieve the Contractor of his liabilities under this contract. 1920.

#### 6. Inspection

All work and material shall be at all times open to inspection, acceptance or rejection of the Engineer or his

duly authorized representative. The Contractor shall provide reasonable and necessary facilities for such inspection. 1920.

### 7. Defective Work or Material

Any omissions or failures on the part of the Engineer to disapprove or reject any work or material shall not be construed as an acceptance of any defective work or material. The Contractor shall remove, at his own expense, any of his work or material condemned by the Engineer during the progress of the work, and shall rebuild and replace the same without extra charge, and in default thereof the same may be done by the Company at the Contractor's expense, or, in case the Engineer should not consider the defect of sufficient importance to require the Contractor to rebuild or replace any imperfect work or material, then an amount to be agreed upon by the Company and the Contractor shall be deducted from the contract price. 1920.

### 8. Indemnity

(a) The Company reserves the right during the prosecution of the work under this contract to run its trains and cars on such schedules and at such rates of speed as it may see fit to do over that portion of the track, along and upon which the Contractor may be working. It therefore assumes entire responsibility for all such traffic, except as otherwise provided in paragraphs (b) to (l), inclusive. 1920.

(b) The Contractor agrees to assume the liability imposed by law (including all liability under the so-called Workmen's Compensation Laws for which it may be or become bound) for personal injuries to the employees of the Contractor due to the negligence of the Contractor or his employees. 1920.

(c) The Contractor agrees to indemnify and hold harmless the Company from all claims for personal injury made against it by employees of the Contractor and due solely to the Contractor's negligence. 1920.

(d) The Contractor agrees to indemnify and hold harmless the Company from all claims for personal injury made against it by an employee of the Company where the injury is sustained while such employee is assisting directly in the performance of the work under this contract and the accident is due solely to the negligence of the Contractor. 1920.

(e) The Contractor agrees to indemnify and hold harmless the Company from all claims for damage to persons or property made against it by persons other than employees, either of the Contractor or of the Company, where such injury does not arise out of or in connection with the operation of cars or locomotives and where such injury is due solely to the negligence of the Contractor. 1920.

(f) Where injury to persons or property is caused by the negligence of the Contractor and the Company jointly, each party agrees to bear all losses to its employees, its own property, or persons or property in its charge or control, and the Contractor and the Company agree to bear jointly, and equally, the losses of all other persons, if any, injured under such conditions. 1920.

(g) The Contractor assumes no other liability for damages either to persons or property and the Company agrees to indemnify and hold harmless the Contractor from all claims for such damages. 1920.

(h) Prior to the delivery of tools and materials by the Contractor to the Company at the latter's receiving station for shipment over its lines to the work, the Contractor assumes the entire risk, without claim or recourse therefor in any event upon the Company. 1920.

(i) After said delivery specified in section (h) and while in the possession of the Company, the Company assumes not only liability for any and all loss or damage to such tools or materials imposed by law upon a common carrier of goods for hire but also such liability until the tracks and structures of the Company are in condition to permit the Contractor to prosecute the work of installation without delay and until delivery is made to the Contractor. 1920.

(j) After the delivery of tools and materials by the Company to the Contractor at the point of installation and prior to the attaching and fixing of materials in place upon the tracks or property of the Company the Contractor assumes the liability for any and all loss or damage to its tools or materials not due to the negligence or fault of the Company or its employees. 1920.

(k) After materials have been attached and fixed in place upon the tracks or property of the Company, the Company assumes the liability for any and all loss or damage thereto not due to the negligence or fault of the Contractor or his employees. 1920.

(l) The Contractor assumes all liability for loss or damage to the Company's property used in the construction of the work covered by this contract due to the negligence of the Contractor, where such loss or damage does not arise out of or in connection with the operation of cars or locomotives. 1920.

### 9. Settlement for Wages

Whenever, in the opinion of the Engineer, it may be necessary for the progress of the work to secure to any of the employees engaged on the work under this contract any wages which may then be due them, the Company is hereby authorized to pay said employees the amount due them or any lesser amount, and the amount so paid them, as shown by their receipts, shall be deducted from any moneys that may be or become payable to said Contractor. 1920.

### 10. Liens

If at any time there shall be evidence of any lien or claim for which the Company might become liable, and which is chargeable to the Contractor. the Company shall have the right to retain out of any payment then due or thereafter to become due, an amount sufficient to completely indemnify the Company against such lien or claim, and if such lien or claim be valid, the Company may pay and discharge the same and deduct the amount so paid from any moneys which may be or become due and payable to the Contractor. 1920.

### 11. Order and Discipline

The Contractor shall at all times enforce strict discipline and good order among his employees, and any employee of the Contractor who shall appear to be incompetent, disorderly or intemperate, or in any other way disqualified for or unfaithful to the work entrusted to him, shall be removed immediately on the request of the Engineer, and he shall not again be employed on the work without the Engineer's written consent. 1920.

### 12. Power of Engineer

The Engineer shall make all necessary explanations as to the meaning and intent of the plans and specifications, shall give all orders and directions contemplated therein or thereby, and shall decide controversies arising between the parties hereto as to the meaning or intent of the plans or specifications and such explanations, orders, directions or decisions of the Engineer shall be final and binding upon both parties hereto, except as otherwise provided in Article 23 of this contract. 1920.

### 13. Order of Completion. Use of Completed Portion

The Contractor shall complete any portion or portions of the work in such order of time as the Engineer may require. The Company shall have the right to take possession of and use any completed or partially completed portions of the work, notwithstanding the time for completing the entire work or such portions may not have expired; but such taking possession and use shall not be deemed an acceptance of the work so taken or used or any part thereof. 1920.

### 14. Changes

(a) The Company shall have the right to make alterations in, addition to, or deductions from, the work without in any manner affecting or making void this contract. 1920.

(b) No changes, additions or deductions shall be made except upon written order of the Engineer and the value of the work so changed, added or deducted shall be agreed upon and added to or deducted from the contract price. 1920.

### 15. Unavoidable Delays

If either the Contractor or the Company shall be delayed in the performance of its covenants and agreements by reason of fire, flood, strikes or other causes beyond its control, the time for completion of the work may be extended, as may be agreed upon, without in any way affecting the conditions of this contract or the liability of sureties on the bond. 1920.

### 16. Suspension of Work

(a) The Company may at any time stop the work, or any part thereof, by giving ..... days' notice to the Contractor in writing. The work shall be resumed by the Contractor in ..... days after the date fixed in the written notice from the Company to the Contractor so to do, and the expense, if any, incurred by the Contractor on account of such suspension or delay of the work, or any part thereof, and the method and date of payments to the

Contractor by the Company shall be agreed upon between the Engineer and the Contractor. 1920.

(b) If shipment of the materials, or any part thereof, is delayed by the Company, the date of completion or such materials by the Contractor and upon verification by the Engineer, shall be regarded as the date of shipment. 1920.

(c) Should the Contractor stop or delay the work, or any part thereof, for reasons other than those mentioned in Article 15 but satisfactory to the Company, the expenses, if any, incurred by the Company on account of such delays or suspension and method and date of payment by the Contractor to the Company shall be agreed upon between the Engineer and the Contractor. 1920.

### 17. Failure to Prosecute the Work

If at any time the work is not progressing to the satisfaction of the Company, the Engineer may notify the Contractor in writing, and if the progress of the work fails to show an improvement, the Engineer may, at his discretion, provide the necessary forces, equipment and materials to properly carry on the work, and cost for so doing shall be deducted from the contract price. 1920.

### 18. Forfeiture

(a) If the Contractor shall fail or refuse to comply with any of the covenants and requirements in this agreement, the Engineer shall notify the Contractor in writing of such failure or refusal and after the expiration of ..... days after such notice has been served, the Engineer may at his discretion declare the contract forfeited and the Company shall have the right to terminate the contract, and the Company may take possession for the purpose of completing the work to be done under the contract, of all the materials, tools and appliances, and to employ any other person or persons to complete the work and to provide the materials therefor. 1920.

(b) In case of such discontinuance of the employment of the Contractor, he shall not be entitled to receive any further payment under this contract until the whole work shall be finished, at which time, if the unpaid amount due the Contractor shall exceed the expense incurred by the Company, the balance shall be paid to the Contractor; but if such expense shall exceed such amount due the Contractor, the Contractor shall pay the difference to the Company. 1920.

### 19. Replacement of Defective Parts

The Contractor shall furnish promptly for replacement, at his own expense, any part or parts of the apparatus and material furnished by him under this contract which within a period of one year after the date of final acceptance of the work shall fail to properly perform its function because of any defect in design, construction or workmanship of said apparatus or material. 1920.

### 20. Patents

(a) The Contractor hereby covenants and agrees to indemnify and save harmless the Company of and from all damage, claims, suits, recoveries or judgments which may arise or be made, had, brought or recovered by reason of or on account of the apparatus, material or systems, or anything used in or about the work to be performed under the contract being infringements or being claimed to be infringements of Letters Patent issued by the United States or any other foreign country, provided the Contractor shall first have prompt written notice of such claim, suit or action and be allowed an opportunity to defend same. 1920.

(b) The Company hereby covenants and agrees not to violate or infringe any of the patents relating to any of the apparatus, materials or systems furnished under this contract, which are controlled by the Contractor or under which the Contractor has manufacturing or selling rights. 1920.

### 21. Payments

Payments for work covered by this contract shall be made in the following manner .....
..... 1920.

### 22. Final Payment

Upon the completion of the work, the Engineer shall certify that all of the work to be done under this contract has been completed and accepted by him under the terms and conditions thereof, whereupon the entire amount found to be due the Contractor shall be paid to the Contractor at ..... within ..... days after date of said certificate, provided, however, that before final payment is made, the Contractor shall submit evidence satisfactory to the Engineer that all payrolls, material bills, and outstanding indebtedness in connection with this work, have been paid. 1920.

### 23. Arbitration

If any difference or dispute shall arise between the parties hereto concerning the performance of this agreement or their respective rights and obligations thereunder, such differences or disputes which cannot be settled between the Engineer and the Contractor shall in all cases be submitted to arbitration, as follows:

In case either party shall seek the appointment of arbitrators, such party shall state in writing to the other party hereto the point or points of difference to be submitted to arbitration and within 10 days thereafter shall notify the other party in writing of the selection of an arbitrator in its behalf and thereupon and within 10 days after such notice said other party shall select an arbitrator and shall give to the party demanding arbitration written notice thereof. Within 5 days thereafter, the two arbitrators thus chosen shall meet, and may adjourn from time to time, and after hearing the evidence of the parties and within 10 days of the last hearing before them shall render their decision and award in writing, and such decision and award shall thereupon be binding and conclusive upon the parties.

If the arbitrators so chosen shall not agree upon the decision or award to be made, they shall select a third arbitrator within 15 days of the last hearing before them, to whom all the evidence theretofore taken shall be submitted, but either party may submit additional evidence, and after such further hearing as the arbitrators or a majority of them may permit, the decision and award of a majority of the three shall be binding and conclusive upon the parties.

If the two arbitrators first chosen shall not agree upon the selection of a third arbitrator, then such third arbitrator may be appointed by any person selected by the parties to the arbitration to make such appointment.

If upon due notice either party shall fail to select an arbitrator within the time allowed for that purpose, the arbitrator appointed by the other party or parties shall have the right to proceed with the arbitration as sole arbitrator, and his written decision and award shall be binding and conclusive upon the parties hereto.

Any party against whom a decision and award may be made, shall have 60 days after service of notice thereof in writing within which to comply therewith, provided the arbitrators, or if there be only one, then the arbitrator shall have power, for good cause shown from time to time, to extend the time for such compliance for a further period not to exceed 30 days in all.

The fees, disbursements and expenses of the arbitrators, or, if there be only one, then the arbitrator shall be borne or paid according to the award of the arbitrators or arbitrator. The counsel fees, disbursements and expenses of each party shall be borne exclusively by such party. 1920.

The committee recommended that the form of contract for block signal and interlocking work be accepted for presentation at the annual meeting for submission to letter ballot for inclusion in the Manual.

Committee: R. C. Johnson (B. R. T.), chairman; H. F. Haag (K. C. S.), vice-chairman; F. H. Buchanan (P. R. R.), J. B. Latimer (C. B. & Q.), John Leisenring (I. T. S.), H. F. Lomas (I. C.), J. C. Mock (M. C.), A. H. Rudd (P. R. R.), J. M. Woldran (I. R. T.).

## Discussion

R. C. Johnson (chairman) presented the report and continued as follows: Since the report was submitted to the secretary for publication the committee has decided to make certain further changes. 8 (g) (Indemnity), the committee wishes to eliminate the last part. This paragraph will then read, "The contractor assumes no other liability for damages, either to persons or property."

Mr. Stevens: Is it possible to so word this clause that it would protect other companies interested in the contract as well as the company letting the contract?

Mr. Johnson: The committee will be glad to consider that. The committee wishes to make a change in Section 23, substituting the words "This agreement" for the words "the arbitration," making the paragraph read:

"If the two arbitrators first chosen shall not agree upon the selection of a third arbitrator, then such third arbitrator may be appointed by any person selected by the parties to this agreement to make such appointment."

The committee moves that the form of contract for block signal and interlocking work be accepted for presentation at the annual meeting for submission to letter ballot for inclusion in the Manual.

W. H. Elliott (N. Y. C.): Has the committee considered anything with reference to a guaranty or warranty clause?

Mr. Johnson: The ordinary guaranties are taken care of in the specification which is part of this contract; there is also a clause covering the replacement of defective parts.

(Motion seconded and carried.)

The committee was dismissed with the thanks of the association.

# Report of Committee IX—Wires and Cables

THE COMMITTEE submitted for consideration at the stated meeting reports on specification for wire joints and specification for copper bond wires.

It recommended that the resolution regarding type of wire insulating machine and preference in the placing of orders, adopted and placed in the Manual in 1912, be withdrawn as not being of such importance as to warrant it being retained in the Manual.

## Specification for Wire Joints

### 1. General

(a) Joints between copper line wires, in tension, shall be made with a copper sleeve, which shall be given 3½ turns in accordance with drawing 1407. 1920.

(b) Joints between iron line wires, in tension, shall be made in accordance with drawing 1405. 1920.

(c) Joints between copper or iron line wires and copper branch wires shall be made, soldered and arranged in accordance with drawings 1403, 1404 or 1411. 1920.

(d) Joints between rubber insulated wires shall be made in accordance with drawings 1406 or 1408. 1920.

### 2. Tinning

(a) Where an iron wire is to be soldered in the form of a joint, it must first be tinned before the wires are twisted together. 1920.

### 3. Soldering

(a) Joints shall be soldered by dipping the wires in, or pouring on, the melted solder until there is a metallic union of the wires for the length of the joint. The flux used shall be non-corrosive. After soldering, the joint shall be wiped clean with a piece of dry and clean cloth or waste. Joints shall be soldered the day made. 1920.

### 4. Insulation and Covering

(a) Joints shall be insulated and covered in accordance with drawings 1403, 1404, 1405, 1406, 1407, 1408 and 1411. 1920.

(b) Joints shall be dry when insulated and covered. 1920.

(c) Joints shall be thickly coated with a rubber cement, made of a solution of pure Para rubber dissolved in benzine, having the consistency of mucilage, which shall be allowed to dry for not less than one minute. Rubber tape of quality prescribed by A.R.A. specification, shall be wound tightly over the joint in successive layers, overlapping one-half its width. The tape so applied shall be warmed to between 120 degrees F. and 250 degrees F. by a blow torch, care being used not to burn the insulation. After heating, the insulation shall be firmly pressed together. 1920.

(d) The joint so insulated shall be tightly wrapped with friction tape, of quality prescribed by A.R.A. specification overlapping one-half its width and extending over ends of braiding of wires forming joint the distance specified on drawing, two layers of the tape being applied. Two coats of black asphaltum paint shall be applied over the tape, the first being allowed to dry thoroughly before the second is applied. 1920.

### 5. Crossarm Support

One crossarm in accordance with drawing 1403 shall be used where there is one dead ended wire and seven or more through wires, or seven or more through wires and two dead ended wires pulling in the same direction but located on opposite sides of the pole. In all other cases two crossarms in accordance with drawing 1404 or drawing 1411 shall be used for all dead ended wires. 1920.

## Specification for Copper Bond Wires

### 1. Wire

(a) The wire shall be No. 6 A.W.G. soft drawn, annealed copper having a conductivity of not less than 98 per cent of that of pure copper, Matthiessen's standard. The wire shall be cylindrical in form, free from flaws, scales and other imperfections. 1920.

(b) The wires shall be cut and straightened to the length specified. The ends shall be square and free from burrs. 1920.

### 2. Properties

(a) The mechanical and electrical properties of the finished wire shall be in accordance with the following requirements:

| A. W. G. | Diameter in Mils. | Per Cent Elongation in 10 Inches | |
|---|---|---|---|
| 6 | 162 | 27 | 1920. |

(b) The wire shall not vary more than one mil. from the normal diameter. 1920.

### 3. Inspection and Tests

(a) The manufacturer shall provide, at the mill, all apparatus and labor for making the required tests under supervision of the purchaser. 1920.

(b) Tests shall be made at the mill, and, or at destination. 1920.

(c) If, upon arrival at destination, the wires do not meet the requirements of these specifications, they will be rejected and returned to the manufacturer, who shall pay all freight charges. 1920.

### 4. Packing for Shipment

(a) The wires shall be put up in bundles of 200, well burlapped at ends and securely fastened in not less than 3 places. 1920.

### 5. Tagging

(a) A tag shall be securely fastened to each bundle, having plainly and indelibly marked thereon the length, the purchaser's order, requisition and inspection number and the shipping address. 1920.

The committee recommended that the specification for wire joints and the specification for copper bond wires be approved for acceptance at the annual meeting for submission to letter ballot for inclusion in the Manual.

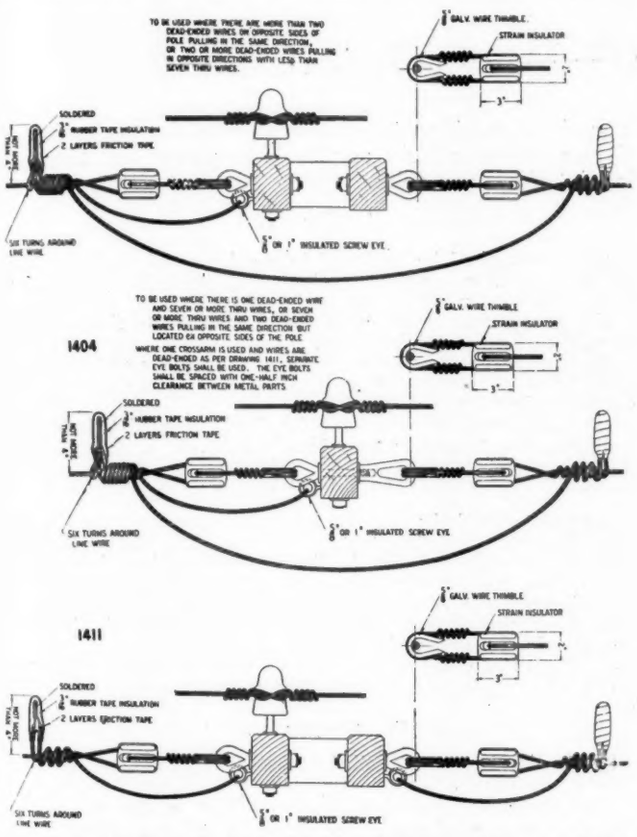
Committee: W. H. Elliott (N. Y. C.), chairman; H. K. Lowry (C. R. I. & P.), vice-chairman; E. L. Adams, F. W. Bender (C. R. R. of N. J.), F. H. Buchanan (P. R. R.), G. W. Chappell (N. Y. N. H. & H.), C. A. Dunham (G. N.), G. A. Kirley (B. & A.), H. W. Lewis (L. V.), B. F. Oler (P. R. R.), A. H. Rice (D. & H.), D. W. Richards (N. & W.), W. Y.

Scott (B. & M.), M. E. Smith (D. L. & W.), Chas Stephens (C. & O.), T. S. Stevens (A. T. & S. F.).

## Discussion

W. H. Elliott (chairman) presented the report.

Mr. Dryden: Regarding 1 (c) in my experience, a line wire under tension, connecting with a branch wire should never be soldered because of the weakening ef-




Iron wires shall be tinned before being twisted into a joint and soldered.

Soldering shall be done by dipping the wires in or pouring on the melted solder. After soldering, the joint shall be wiped clean.

Joints shall be dry when insulated and covered.

Joints, before rubber tape is applied, shall be thickly coated with a rubber cement and allowed to dry for not less than one minute.

Rubber tape shall be wound in successive layers over joint to the thickness specified. The tape so applied shall be warmed to between 120 deg. and 250 deg. F.

Friction tape shall be wrapped over rubber insulation and extend over ends of braiding of wires forming the joint. Two layers shall be applied. Two coats of black asphaltum paint shall be applied over the tape.

**1403—Branch Connection to Line Wire Double Cross-Arm Support**

**1404—Branch Connection to Line Wire Single Cross-Arm Support**

**1411—Branch Connection to Dead-Ended Line Wire Double Cross-Arm Support**

fect on the wire. There are too many breaks in that kind of construction.

Mr. Elliott: The specification does not provide for the construction which Mr. Dryden has criticized. The committee believes that the practice prescribed by these drawings is the best that has yet been devised, and will be safe and satisfactory.

J. A. Peabody (C. & N. W.): As to the cost of this method in comparison with other methods, I might state that the materials recommended by the committee will cost about 10 cents less, and the labor will be more about an equal amount.

Mr. Elliott: I move that drawing 1403 be accepted, to take the usual course. (Motion seconded and carried.)

Mr. Elliott: I move that drawing 1404 be accepted, to take the usual course. (Motion seconded and carried.)

Mr. Elliott: I move that drawing 1405 be accepted, and take the usual course.

(Motion seconded.)

T. C. Seifert (C. B. & Q.): At the New York meeting we had considerable discussion regarding this joint. It was the sense of the association that this joint was not a good one, and was to be eliminated.

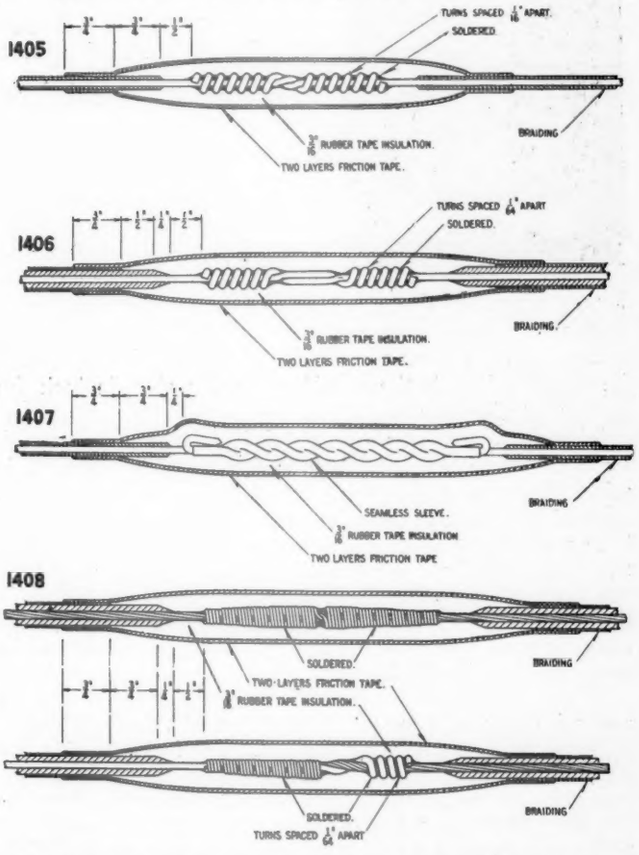
Mr. Elliott: That was with reference to copper line wire. This is iron line wire.

Mr. Seifert: At present we use tin sleeves for iron line wire and have no trouble. We find that this joint, in process of soldering, becomes brittle and breaks.

(Motion carried.)

Motions were next made and carried for the acceptance of drawings Nos. 1406, 1407, 1408, 1411.

Mr. Elliott: The committee moves that specification for copper bond wires be accepted, and take the usual




Soldering shall be done by dipping the wires in or pouring on the melted solder. After soldering, the joint shall be wiped clean.

Joints shall be dry when insulated and covered.

Joints, before rubber tape is applied, shall be thickly coated with a rubber cement and allowed to dry for not less than one minute.

Rubber tape shall be wound in successive layers over joint to the thickness specified. The tape so applied shall be warmed to between 120 deg. and 250 deg. F.

Friction tape shall be wrapped over rubber insulation and extend over ends of braiding of wires forming the joint. Two layers shall be applied. Two coats of black asphaltum paint shall be applied over the tape.

**1405—Weatherproof Insulated Iron Line Wire Joint**

**1406—Rubber Insulated Solid Copper Wire Joint**

**1407—Weatherproof Copper Line Wire Sleeve Type Joint**

**1408—Stranded Wire Joint**

course. This specification is along the lines of the specification for the iron bond wire already in the Manual.

B. T. Anderson (D., L. & W.): Is it possible to get wire with the variation of one mill?

Mr. Elliott: The leeway permitted in iron wire is

three mills, but copper wire is drawn much closer, and this was changed to one mill on the statement of the manufacturers.

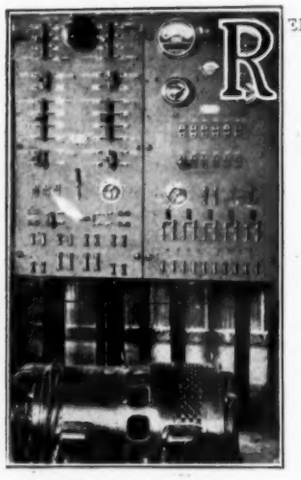
(Motion seconded and carried.)

Mr. Elliott: The committee recommends that the resolution regarding type of wire insulating machine and preference in placing orders, adopted and placed in the Manual in 1912, be withdrawn. I move its withdrawal from the Manual be accepted for presentation to the annual meeting, and for submission to letter ballot.

(Motion seconded and carried.)

The committee was dismissed with the thanks of the association.

# Report of Committee III—Power Interlocking



REPORTS WERE submitted by the committee on the following subjects:

Specification for electric lock for mechanical interlocking machine.

Specification for renewable cartridge fuses.

Specification for universal electric motor switch operating and locking mechanism.

The report on specification for electric lock for power interlocking machines was submitted at the 1919 annual meeting, and also at the stated meeting in New York, December 2 and 3, 1919.

At the December meeting it was suggested that the committee consider a specification for electric lock for mechanical interlocking machines to determine whether such a specification could be combined with the specification for electric lock for power interlocking machines.

The committee was of the opinion that the two specifications could be combined and with this thought in mind it presented only such additional sections as seemed desirable to have the specification applicable for both power and mechanical interlocking machines. The additional sections were submitted for discussion with the thought that after this meeting, and before the specification is submitted at the annual meeting, that a joint meeting would be held with Committee II to obtain its views and recommendations.

It was suggested at the December meeting that coils and windings of enameled wire as well as of cotton or silk-covered wire be impregnated. On investigation the committee reported that the impregnating compound may be used at a temperature as high as 328 degrees F., while 212 degrees F. is the maximum specified temperature to which enameled wire is subjected and 86 degrees F. is the maximum subsequent temperature at which it is supposed not to crack when the wire is bent. The data is now in the Manual under specification for "Impregnation Treatment of Coils and Windings" and for "Enameled Copper Magnet Wire."

Further investigation developed that impregnation of coils wound with enameled wire was impracticable. Experience has shown that the process of impregnating enamel wire softens the enamel. For this reason the committee recommended no change in section 7-a, reading:

Coils and windings shall be of cotton or silk-covered wire impregnated; of enameled wire, or as shown on requisite sheet. Enameling or impregnation shall be in accordance with R. S. A. specifications. (G.E.R. 32-a) 1919.

The following are the additional sections which the committee considered desirable to have for the specifications on electric locks applicable to power and mechanical interlocking machines:

### 4. Design

(c) Locks shall be enclosed in a substantial metallic case, the doors and coverings of which may be locked or sealed, as specified on requisite sheet. 1920.

(h) Locks shall be designed for application to the machine as specified on requisite sheet. 1920.

(i) Operating connection between the rocker and the lock shall be so constructed that it cannot be disconnected without removing the lock cover. 1920.

(j) Wire leads to magnet coils shall be insulated flexible copper and not smaller than No. 18 A.W.G. 1919.

### 6. Contacts

(a) Contacts shall:

1. Make a wiping contact. 1919.
2. Be so adjusted that in their open position there shall be not less than .050 in. between contact points. 1919.
3. Be of material specified on requisite sheet. 1919.
4. Be designed to carry continuously and break the current specified on requisite sheet. 1919.
5. Open and close as specified on requisite sheet. 1919.

(b) The number of contacts shall be as specified on requisite sheet. 1919.

### 9. Operation

(a) Lock armature shall be mechanically forced to the locked position by the manipulation of the lever. 1920.

The greater portion of the sections in the specification for renewable cartridge fuses have been taken from the 1918 National Electric Code, A. R. A. standard sections, where they were applicable. This specification was submitted for discussion.

## Specification for Universal Electric Motor Switch Operating and Locking Mechanism (First and Second Range Voltage)

A report on specification for electric motor switch operating and locking mechanism was submitted at the June, 1918, meeting; at the June, 1919, meeting, and at the annual meeting in September, 1919. It was again submitted with what additional data has been collected since the September, 1919, meeting.

For reference only Fig. 2 and Table 1 were submitted, showing prony brake test on G.R.S. model 2 switch machine, 110 volt, d.c. These tests were made to determine the average thrust on switch operating rods in terms of the operating motor and gear train, prony brake test on model 2, 110 volt d.c. switch machines was made, applying brake to the gear wheel which drives the operating cam. The motor was run with fields in series and again with fields in multiple. Torque and r.p.m. of brake wheel and volts and amperes input to the motor were read. This test was made by running 5 sec. and then standing 5 min., alternately. The temperature of the test was about 75 degrees F. and temperature rise of motor windings during test was 9 degrees F. Commutation was entirely satisfactory through entire current range. The data on Table I is the result and an input-output curve was

plotted from this data. Fig. 2, which is not shown, was made up from the data on Table I.

TABLE I. PRONY BRAKE TEST ON MODEL 2 G. R. S. 110 VOLT, D.C. SWITCH MACHINE

| Brake Ft.-Lb. Torque | Output R.P.M. | Energy Amperes | Input Volts | Output B.H.P. | Input H.P. | Efficiency Per Cent |
|---|---|---|---|---|---|---|
| | | | I | | | |
| | | | Fields in Series | | | |
| 22 | 48 | 7.5 | 112 | .201 | 1.13 | 18 |
| 30 | 42 | 10 | 111 | .24 | 1.49 | 16 |
| 38 | 36 | 11.5 | 110 | .... | 1.70 | .... |
| 46 | 30 | 12.5 | 110 | .263 | 1.84 | 14.3 |
| 54 | 24 | 13 | 110 | .... | 1.92 | .... |
| 62 | 24 | 14 | 110 | .284 | 2.06 | 13.6 |
| 70 | 24 | 15 | 110 | .... | 2.21 | .... |
| 78 | 24 | 16 | 110 | .356 | 2.36 | 15 |
| 86 | 24 | 16.5 | 110 | .... | 2.44 | .... |
| 94 | 24 | 16.75 | 110 | .428 | 2.47 | 17½ |
| 102 | 18 | 17.5 | 110 | .... | 2.58 | .... |
| 110 | 18 | 17.75 | 110 | .377 | 2.62 | 14½ |
| 118 | 18 | 18.25 | 110 | .... | 2.69 | .... |
| 126 | 15 | 19 | 109.5 | .360 | 2.79 | 13 |
| 134 | 15 | 19.5 | 109 | .... | 2.85 | .... |
| 142 | 15 | 20 | 109 | .407 | 2.92 | 13.7 |
| 150 | 15 | 20.5 | 109 | .428 | 3.00 | 14.3 |
| | | | Fields in Multiple | | | |
| 16 | 60 | 4½ | 118 | .183 | .713 | 25.6 |
| 32 | (40) | 5.6 | 118 | .244 | .885 | 27.6 |
| 48 | 36 | 6.5 | 118 | .329 | 1.02 | 32.2 |
| 64 | 30 | 7.0 | 116.5 | .365 | 1.09 | 33.5 |
| 80 | (27) | 7.5 | 116 | .411 | 1.17 | 35.1 |
| 96 | 24 | 8.0 | 116 | .44 | 1.24 | 35.5 |

Five second runs: T = Torque foot-pounds.

$$BHP = \frac{2\pi \times T \times \text{r.p.m.}}{33000}$$

From the curve the output (h.p. applied to switch) may be read for any h.p. input.

B.h.p.— output, from input — output curve = h.p.

$$\text{Power applied to the switch} = \frac{F \times D}{550} \qquad (1)$$

where F = force pounds (average thrust) and D = throw in ft. per sec. of switch.

$$\text{Therefore } F = \frac{550 \times \text{h.p.}}{D} \qquad (2)$$

t = time (sec.) per operation of switch,
i = inches throw of switch,
i/12 = feet throw of switch and ft. per sec. of switch $= \frac{\text{feet}}{\text{sec.}} = \frac{i/12}{t} = i/12t = D.$ (3)

Substituting (3) in (2)

$$F = \frac{550 \times \text{h.p.}}{i/12t} \text{ and clearing,}$$

$$\text{Average thrust-pounds} = F = \frac{500 \times \text{h.p.} \times 12t}{i} \qquad (4)$$

Discussion at the September, 1919, meeting indicated that some of the manufacturers felt that requirements 3-g (old 3-f) and 3-h (old 3-g) were too severe and desired more time to make tests to satisfy themselves regarding what loads their present type of switch machine would handle in the required time.

The committee does not recognize that tests on existing apparatus have anything to do with the specification, any more than to bring out as a matter of information what such existing apparatus will do. To support the committee's contention, tests on various switch, movable point frogs and detector bars were made. There is no assurance that the tests made show the most severe cases and they should be considered averages of the kinds presented.

The average pounds thrust through the three stages of stroke in one test are less than 700 lb.; however, the committee recommended the 700-lb. requirement, as it is felt that this is not too high and will allow only nominal margin of thrust for future growth of loads to be handled.

Some manufacturers have objected to the loading for the low voltage machine, as given in section 3-g. The committee desired to explain its recommendation for the average thrust of 700 lb. in both sections 3-g and 3-h.

The committee finds that first range voltage machines are being used interchangeably under the loads encountered in interlocking plants of second range voltage, and therefore, of necessity, should be capable of handling the same loads as the second range voltage machines.

The above explanatory statements were made by the committee with the expectation of there being opposition arguments presented by the manufacturers with the view of making the specification apply to existing apparatus instead of making their apparatus fit the specification.

The committee feels no progress can be made if a specification is drawn which will admit all apparatus in the market whether or not such apparatus is satisfactory or capable of measuring up to the requirements recommended by it which in its opinion is necessary.

Certain parts of the specification as revised and submitted for discussion are given below:

## 3. Operating Requirements

(a) Mechanism shall perform its normal operation in the following sequence:
1. Operate detector bar to the full upward position and unlock switch. 2. Throw switch. 3. Lock switch and operate detector bar (in the same direction) to full downward position. 4. Indicate.

(d) Mechanism shall be so constructed that locking device cannot complete its movement nor indication take place unless the lock rod (or rods) has moved to the normal or full reversed position and the position of the mechanism corresponds thereto. 1920.

(e) Circuit controlling devices shall be so constructed that they will, for proper operation, be dependent upon the movement of the lock rod. 1920.

(f) Switch circuit controller for proper operation shall be dependent upon the movement of the switch points. 1920.

(g) (Old f) Normal operating voltage for first range mechanism shall be 20; the time of operation with this voltage at the motor terminals with an average operating thrust of 700 lb. shall not exceed 30 sec., nor shall it exceed 40 sec. at a voltage of 20 per cent below normal. 1919.

(h) (Old g) Normal operating voltage for second range mechanism shall be 110; the time of operation with this voltage at the motor terminals with an average operating thrust of 700 lb. shall not exceed 4 sec., nor shall it exceed 5 sec. at a voltage of 10 per cent below normal. 1919.

(i) (Old h) Mechanism shall be capable of withstanding stress equivalent to a thrust of 10,000 lb. on any operating connection. 1920.

## 4. General Design

**(a) Internal wiring.**

All internal wiring, neatly arranged, shall be placed in ducts or chases of ample capacity and shall form an integral part of the apparatus, flexible rubber insulated wire, not less than No. 14 A.W.G., provided with eyelets at each end, shall be used. Terminals for external wiring shall be located immediately adjacent to wire inlet and sufficient duct space provided to accommodate such conductors. Terminals shall be in accordance with R.S.A. 1070. A wiring or connecting diagram shall be located in a conspicuous place in the mechanism case. 1920.

**(b) Mechanism.**

1. Circuit controlling devices shall be housed in a separate compartment of the mechanism case, and shall, so far as possible, be non-sweating and dirtproof and have separate metallic cover. 1920.

2. Contact space for four independent circuits shall be provided, in addition to those necessary for control of the mechanism; the contacts shall be so designed that they will be positive in action and each can be adjusted to open or close as specified on requisite sheet. 1920.

**(d) Bearings.**

(a) Bearings shall be of ample dimensions to insure reasonable durability. 1919.

(b) Motor bearings shall be so designed as to prevent oil from them getting on the brushes, commutator or windings. 1920.

(c) Means shall be provided for necessary lubrication of bearings surfaces. 1919.

(d) Exposed oil holes shall be provided with weather-proof oil cups or covers. 1920.

**(e) Clearance.**

(a) Mechanism case and motor assembled, shall be designed for two tie supports and when applied shall extend not more than 2-in. above the top of rail (assuming 60 lb., 4½-in. A.S.C.E. rail), and at points of support, not more than 4¼-in. below base of rail. 1920.

Committee: F. B. Wiegand (N. Y. C.), chairman; F. W. Pfleging (U. P.), vice-chairman.

Sub-Committee "A": A. B. DuBray (I. C. C.), chairman; F. J. Ackerman (K. C. T.), N. S. Lynch (Mo. Pac.), J. W. McCormack (K. C. T.), O R. Unger (Mo. Pac.), G. A. Ziehlke (U. P.).

Sub-Committee "B": B. J. Schwendt (T. & O. C.), chairman; E. T. Ambach (B. & O.), J. S. Dewey (C. C. C. & St. L.), J. H. Oppelt (N. Y. C. & St. L.), T. C. Seifert (C. B. & Q.), W. C. Sibila (N. Y. C.).

Sub-Committee "C": L. E. Carpenter (P. R. R.), chairman; E. N. Fox (B. & M.), F. L. Ball (D. L. & W.), Charles Soper (L. I.), Walter Tyler (L. I.), G. C. Whitney (N. Y. M. Ry.).

### Discussion

R. M. Phinney: I suggest that the following paragraph be added. "The proper operation of the locking features must be electrically or mechanically checked during each operation."

Mr. Wiegand: The committee will consider that.

J. E. Stephenson: (G. R. S. Co.) In 4 (h) and 4 (c), is it intended that neither end of the operating connection shall be disconnectable without removing the lock cover?

Mr. Wiegand: This only refers to the connection at the lock end.

T. J. O'Meara (N. Y. C.): In 4 (j), it states that the magnet coils shall be insulated. I have noticed on a good many insulated wires that the insulation was destroyed. It might be well to state what is the best insulation.

Mr. Wiegand: The committee will look into that. The committee desires to know whether it is the sense of the meeting that the specification for power interlocking machines and mechanical interlocking machines should be combined in one specification?

T. S. Stevens (A. T. & S. F.): I move they be combined.

(Motion seconded and carried.)

Mr. Wiegand: The committee moves the acceptance of this report for submission at the annual meeting for approval and ballot.

(Motion seconded and carried.)

Mr. Stoltz: In the specification for renewable cartridge fuse it states that the fusible link shall be packed in a non-combustible powder. The manufacturers of a renewable fuse are not at present using the powder, and I understand that the Underwriters Laboratories have approved those without the powder.

A. B. DuBray (I. C. C.): There are fuses on the market that do use it, and are passed by the Underwriters Laboratories.

Mr. Stoltz: I move the elimination of powder.

(Motion seconded and carried.)

A motion was made and carried that the screw contact fuses be eliminated from the specification.

Mr. Stoltz: Do I understand that the fusible link must extend out of the case where the rating will be visible? Would a case having a hole in the top, with the link turned over and the capacity of the fuse stamped on it, meet the specification?

Mr. DuBray: That would come within the specification. The committee recommends that this specification with the corrections, be presented at the annual meeting for letter ballot and inclusion in the Manual.

(Motion seconded and carried.)

Mr. Schwendt, Chairman of the sub-committee, presented the report on Specifications for Universal Electric Motor Switch Operating and Locking Mechanism. (First and Second Range Voltage.)

J. E. Stephenson (G. R. S. Co.): In regard to 3 (a) 3, I would like to see the words that are included in the parentheses struck out. That is contrary to a number of well known designs which will undoubtedly be continued in the future. I also suggest that the wording in (d) be changed, as follows: "Mechanism shall be so constructed that indication cannot take place unless lock rod has moved to the normal or reverse position, and the locking device has completed its stroke, the position of the mechanism corresponding thereto."

Mr. Schwendt: Since the advance notice went to print, the committee had another meeting, and conducted a number of tests. If the specification is permitted to stand as it is, existing types of motors for the first range machines are not generally capable of performing the load specified in the time specified, as given in 3 (g).

C. H. Morrison (N. Y. N. H. & H): We have quite a number of low voltage machines in service, operating on 20-volt storage battery. It requires 20 sec. to move the switch only, that is without bar or derail. We are receiving satisfactory service.

J. B. Latimer (C. B. & Q.): About 31 sec. is our average, with low voltage switch machines operating on primary battery. We do not find any operating difficulties.

Mr. Schwendt: In order to conform to present practice, it will require changing 3 (g) so that 30 becomes 40, and 40 becomes 50.

P. E. Carter (G. R. S. Co.): We suggest a figure of 350 lb., which is above the ordinary switch, for the actual requirement, to couple up with the time, etc., as the means of showing the ability of the switch machines.

Mr. Elliott: We have made some very extensive tests on switches, using 105-lb. rail, and, owing to the tightening up of the angle-bars which the maintenance of way department requires, our average throw on the switch connection is in excess of 500 lb. I believe a thrust of 350 would be entirely below our requirements, and that 30 sec. is the proper time in which a switch of low voltage should operate.

J. Latimer: It is not my practice to use low voltage switch machines in important places, nor do the switches have to be thrown very often. Our heaviest rails are 100 lb., and tests show that 350 lb. will do the work.

Mr. Fugina: There is a considerable difference of opinion here. The manufacturers say that 350 lb. is the proper specification, and the committee says 700 lb. They should be able to get together on an average. I believe that 350 lb. is too low, and I am inclined to the opinion that 700 lb. is too high.

Mr. Schwendt: The committee moves that 3 (g) be accepted as printed.

(Motion seconded and carried.)

Mr. Schwendt: The committee moves the approval of 3 (h) as printed.

(Motion seconded and carried.)

Mr. Schwendt: The committee would like to change 3 (i) to read: "Mechanism in locked position shall be capable of withstanding maximum stress equivalent to a thrust of 20,000 lb. on any operating connection." I so move.

(Motion seconded.)

Mr. Stephenson: I would not like to see the matter closed until we have sufficient time to determine whether we can conscientiously submit to that test.

Mr. Schwendt: In raising the requirement to 20,000

lb. the committee has in mind confining the breakage in case the switch is run through, not to the machine, but perhaps to a buckling of the connections.

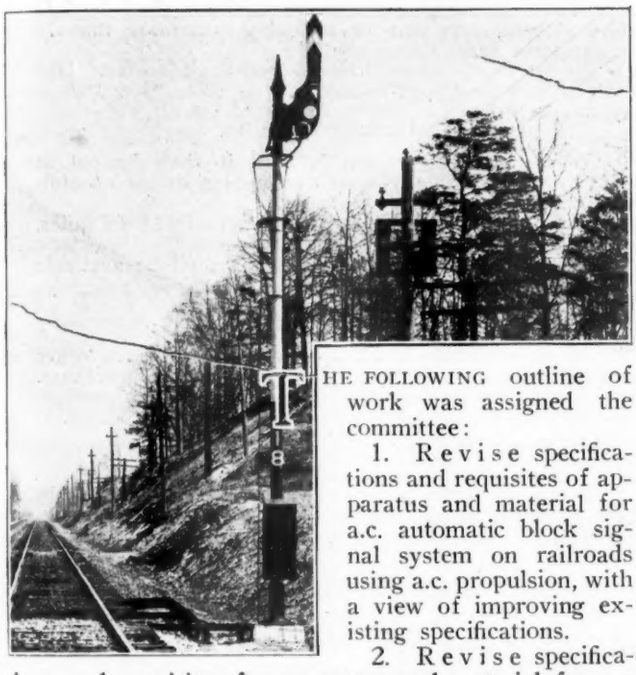
Mr. Elliott: The committee's point that this load should be 20,000 lb. is a good one. However, if they change the last four words, "on any operating connection," to "on the switch connecting rod," it would answer the purpose. A future requirement will take care of the detector bar connection.

Mr. Schwendt: The committee will accept that, and withdraw our motion. I move that the Specification for Universal Electric Motor Switch Operating and Locking Mechanism be accepted for presentation to the annual meeting, for submission to letter ballot and inclusion in the Manual.

(Motion seconded and carried.)

The Committee was dismissed with the thanks of the association.

# Committee VIII—A. C. Automatic Block Signaling



THE FOLLOWING outline of work was assigned the committee:

1. Revise specifications and requisites of apparatus and material for a.c. automatic block signal system on railroads using a.c. propulsion, with a view of improving existing specifications.

2. Revise specifications and requisites for apparatus and material for a.c. block signal system on railroads using d.c. propulsion, with the view of improving existing specifications.

3. Revise specifications and requisites for apparatus and material for a.c. automatic block signal system on railroads using other than a.c. or d.c. propulsion, with the view of improving existing specifications.

4. Prepare specification for: (a) Air-cooled reactors. (b) Choke coils. (c) Indicators. (d) Power supply. (e) Relays. (f) Repeaters. (g) Track circuits.

5. Review characteristics of a.c. apparatus for interlocking plants.

6. Prepare data relating to a.c. track circuit characteristics.

7. Review subject matter for switchboards, a.c. power, harmonizing same with specifications for switchboards, d.c. power.

8. Prepare instructions for installation of switchboards.

The committee submitted for consideration at the stated meeting the following specifications:

Specification for a.c. automatic block signal system; specification for air-cooled reactor for line and track circuits; specification for resistor for line and track circuits and a specification for switchboards. The committee recommended that the above specifications be accepted for presentation at the annual meeting for submission to letter ballot and inclusion in the Manual.

In the following specification for a.c. automatic block signal system only the sections bearing the 1920 date are given; the general provisions, the standard sections and the general electrical requirements sections are omitted. The 1920 sections follow:

### 4. Drawings

(e) Purchaser's drawings listed on requisite sheet and forming an essential part of the specifications, are as follows:

1. Station maps drawn to scale showing track arrangement and surroundings. 2. Profile. 3. Location plan:

(a) A location plan drawn to scale, showing the arrangement of tracks, the location of interlocking stations, power stations, location, numbering, type, arm travel, and control (R.S.A. symbols) of existing and proposed signals, steam and electric railway crossings, highway crossings, highway crossing alarms, track circuit limits, trestles, stations, pole line or other supports for line wires or aerial cables, approximate number of poles per mile, average distance of nearest pole from each signal or relay box to which line wire connections are required, notations showing the sections of rail and drilling of rail joints, and such other information as is desirable.

4. Circuit plans for all existing installations in the territory to be signaled.

5. Typical circuit plans:

(a) Plans showing typical circuits for the control of power-operated signals, switch indicators, protection for facing and trailing switches, main-line and siding crossovers, highway crossing alarms, train order signals and other devices.

6. Standard and other plans:

(a) Such standards and other drawings as the purchaser desires.

(f) Contractor's drawings:

3. Not more than the number of days called for on requisite sheet after award of the contract, and before work is begun, the contractor shall furnish, for the approval of the purchaser, the drawings specified on requisite sheet.

4. Not more than the number of days called for on requisite sheet after the receipt of these drawings, the purchaser will indicate any corrections that may be necessary, or signify his approval.

5. The contractor shall be responsible for the correctness of all drawings furnished by him, although the drawings may have been approved by the purchaser.

6. Any work done prior to the approval of the contractor's drawings will be done at the contractor's risk.

(g) No change shall be made in any approved drawing without the written consent of the purchaser.

### 6. Contract

(b) As soon as practicable, after the award is made, copies of the contract in accordance with the accompanying form, will be presented to the contractor for signature, after which all copies will be signed by the purchaser and two will be returned to the contractor. The number of copies shall be as specified on requisite sheet.

### 9. Furnished by the Purchaser

(d) The purchaser will furnish material or labor, or both, on items indicated on requisite sheet subject to the inspection of the contractor, who shall state any objections thereto before starting his part of the work. After rectification by the purchaser of any defects reported, the contractor shall assume full responsibility for the proper functioning of the installation. The intent of this section is to bar any claim by the contractor that the work done by the purchaser has not been performed in such manner as to enable him to fulfill all of the provisions of the contract.

### 11. Shipment of Material

(b) Shipment of material shall be made as specified on requisite sheet.

### 12. Transportation

(c) Transportation shall be furnished as specified on requisite sheet.

### 14. Inspection of Installation

(b) The contractor shall advise the purchaser the number of days specified on requisite sheet, in advance of the time the installation will be completed and ready for final inspection. The purchaser will make inspection and tests, within the number of days specified on requisite sheet, after the completion of the work.

### 16. Use of Hand and Other Cars

(c) The use of cars specified on requisite sheet will be permitted and when used, contractor shall comply with purchaser's rules.

### 18. Placing in Service

(d) After receipt of written authority from the purchaser, the contractor shall place the installation in service under the supervision of the purchaser and shall leave competent men on duty for a period thereafter as specified on requisite sheet.

(e) The purchaser will place the installation in service, in the event that he does not authorize the contractor to do so within the time specified on requisite sheet after the completion of the work to the purchaser's satisfaction.

## Detail Provisions

### 50. Power Supply

(b) Apparatus shall be so located as to be easily accessible for operation, attention to bearings, adjusting and cleaning.

(c) When internal combustion engines are used, contractor shall install muffler outside of building as approved by purchaser.

(d) The following power plant equipment shall conform to R.S.A. or A.R.A. specifications:

1. Gasoline engines. 2. Alternators. 3. Motors. 4. Motor generators. 5. Switchboards.

### 78. Power Distribution

(a) The drop in voltage supply under normal conditions between the source of power supply and the far end of any feeder shall not exceed 10 per cent, and shall not interfere with proper operation of the signals when power is restored to the line.

(b) Power for track circuits shall be obtained from individual track transformers or independent track transformers with a separate secondary winding for each track circuit as specified on requisite sheet.

(c) Power for circuits other than track shall be obtained direct from secondary of line transformer or by the use of additional transformers, as specified on requisite sheet.

(d) A voltage at the terminals of all operated units shall be within five per cent of their rated voltage at full load with normal voltage at the source of supply. A track circuit shall be considered as an operated unit and measurement of voltage is to be made at secondary of track transformer.

(e) Power lines shall be sectionalized as specified on requisite sheet.

### 270. Foundations

(c) Dimensions and elevations of concrete foundations shall conform to drawings as specified on requisite sheet.

### 271. Foundation Bolts

(a) Foundation bolts shall be as specified on requisite sheet.

### 280. Concrete

(a) Concrete shall conform to R. S. A. specification.

### 400. Signals

(a) Signals shall conform to A. R. A. specifications.

### 500. Circuits

(a) Circuits shall conform to the contractor's recommended practice, unless otherwise specified on requisite sheet.

### 502. Track Circuits

(a) Track circuits shall be continuous on all main tracks and extend the full length of crossovers and to the fouling point of turnouts, unless otherwise specified on requisite sheet.

### 520. Wire

(a) Wire and cables shall conform to R. S. A. specifications, unless otherwise specified on requisite sheet.

### 521. Size of Conductors

(a) Wires shall be of sufficient size to permit operation of apparatus, in accordance with R.S.A. specifications.

(b) Single conductor wire smaller than No. 14 A.W.G. shall not be used for exterior wiring.

(c) No wire smaller than No. 16 A.W.G. shall be used for exterior or interior wiring.

(d) No line wire smaller than No. 12 A.W.G. shall be used.

### 526. Wiring

(a) Wires in trunking chases or conduits shall be laid loosely, without stretching or crowding, not more than 75 per cent of the space being used.

(e) Eyelet terminals shall be used on flexible wire. Tips of eyelets shall be dipped in solder.

### 527. Common Return

(a) Where common return is used it shall be cut at locations where possible without overlapping or use of additional instruments.

(b) Length of common return shall not exceed six miles, unless otherwise specified on requisite sheet.

(c) Where common return is used, it shall be available for test at locations of all apparatus.

### 528. Joints in Wires

(a) Joints or breaks shall not be made in wires other than open line wires except by permission of the purchaser.

(b) Joints shall be located where accessible for inspection.

(c) Method of making joints shall conform to A.R.A. specification.

### 531. Wire Terminals

(a) Terminals for wire and cable conductors shall be in accordance with R.S.A. 1056 and shall be installed in an accessible position and neatly arranged on terminal boards in housings.

### 540. Bonding Wires for Other Than Propulsion Bonding

(a) Bonding wires shall conform to R.S.A. specification.

(b) Bonding wires shall be of material specified on requisite sheet.

(c) Bonding shall be in accordance with drawing specified on requisite sheet. Rail joints, except as below, shall be bonded with two bonding wires; when located in platforms or road crossings, whether of plank, brick, or ballast filling, four wires must be used at each joint, two being placed on either side of rail and outside of the angle bar.

### 542. Channel Pins

(a) Channel pins shall conform to R.S.A. specifications, unless otherwise specified on requisite sheet.

(b) Channel pins shall be driven on same day holes are drilled and in same direction.

(c) Bond wires shall be free and move with channel pins as they are being driven.

### 610. Circuit Controllers

(a) Switch circuit controllers shall conform to A.R.A. specification.

(b) Switch circuit controller connections shall be in accordance with R.S.A. 1223.

(c) Non-interlocked single main line switches, both ends of crossover switches and siding derails, when not directly connected to the switch, shall be equipped with switch circuit controllers.

(d) Switch circuit controllers shall be connected to the normally closed point.

(g) Plunger lock, drawbridge, lever latch circuit controllers and circuit controllers for mechanically interlocked signals shall be used as specified on requisite sheet.

### 705. Supports for Wood Trunking

(c) When trunking exceeds a width of seven inches, additional support shall be provided as specified on requisite sheet.

(e) A piece of capping eight inches long and the width of trunking shall be placed between the trunking and each support.

(f) Each joint in the bottom of the trunking shall have a support.

(g) When trunking is extended across ditch or other depression necessitating a span of more than 5 ft., it shall be reinforced by a piece of rough yellow pine or oak 4 in. by 6 in. in size, laid horizontally and with suitable supports under end of reinforcing piece.

(h) Exposed trunking crossing under tracks containing other than track circuit wires shall be protected by metal covering between rails.

The specification for air-cooled reactors for line and track circuits as presented at the meeting for approval for submission to the annual meeting to be acted upon by letter ballot for inclusion in the Manual consisted of 15 sections. The sections covering the requisite sheet, tender, tests, inspection, packing, marking and warranty are standard sections; those pertaining to insulation and dielectric requirements are general electrical requirements sections. The section or design was presented in 1917, as were those covering capacity, adjustment, name plate and temperature rise. The following paragraphs were added to the requisite sheet:

(e) Inspection and tests.

1. Inspection and tests { shall / shall not } be made at the point of production under supervision of purchaser.

2. Purchaser requests ..... days' notice before apparatus will be ready for inspection and tests.

3. Inspection and tests { shall / shall not } be made at destination by purchaser.

4. Inspection and tests as made by contractor { shall / shall not } be acceptable.

## Specification for Resistor for Line and Track Circuits

Under this specification, section 1, requisite sheet; section 3, tender; section 11, tests; section 12, inspection; section 13, packing; section 14, marking, and section 15, warranty, are standard sections, while sections 9 and 10 on insulation and dielectric requirements are general electrical requirements sections.

### 4. Rating

(a) The rating of the resistor shall be as specified on requisite sheet.

(b) Rating shall cover the total resistance of the resistor and taps as required, also the total capacity of the resistor in watts.

### 5. Name-Plate

(a) Each resistor shall have a tag, paster or name-plate showing: (a) Manufacturer's name. (b) Drawing or other reference number. (c) Resistance in ohms. (d) Continuous capacity in watts.

### 6. Temperature Rise

(a) The temperature rise of the resistor by the thermometer shall not exceed 75 degrees C. (167 degrees F.) based on a room temperature of 20 degrees C. (68 degrees F.) for continuous radiation of the wattage specified on requisite sheet.

(b) When the resistor is to be used for intermittent service, the permissible wattage radiation may vary, depending upon the operation of the intermittent current. The temperature rise corresponding thereto shall not exceed 100 degrees C. (180 degrees F.) based on a room temperature of 20 degrees C. (68 degrees F.).

### 8. Terminal Board

(a) Terminal board shall be as specified on requisite sheet and marked to show the resistance between taps.

The following paragraphs were added under section 16, requisites:

(d) Material:

Resistors shall be furnished in accordance with following drawings:

..... ..... .....

..... ..... .....

(e) Inspection and tests:

1. Inspection and tests { shall / shall not } be made at point of production under supervision of purchaser.

2. Purchaser requests ..... days' notice before apparatus will be ready for inspection and tests.

3. Inspection and tests { shall / shall not } be made at destination by purchaser.

4. Inspection and tests as made by contractor { shall / shall not } be acceptable.

5. Connection diagram.

(a) Connection diagram { shall / shall not } be furnished.

(b) Resistance between terminals.....

(c) Total resistance.....

## Specification for Switchboard

Under this specification the following sections are standard sections: Purpose, tender, requisite sheet, inspection, packing, material and workmanship, marking and warranty. The sections on identification and insulation are general electrical requirement sections. The following were the 1920 sections submitted to the meeting:

### 4. Design

(a) Switchboard shall be of a design approved by the purchaser.

### 5. Panels

(a) Panels must be of oil-finished natural black slate, free from metallic veins and flaws or as specified on requisite sheet.

(b) Marble panels, if specified, shall be polished on front and edges, and varnished on the back.

(c) Panels shall be arranged as specified on requisite sheet.

(d) Panels shall be 1½ in. thick for all sizes up to and including 48 in. in height and 32 in. in width and 2 in. if either dimension is exceeded, or as specified on requisite sheet.

(e) Bevel of edges shall be as specified on requisite sheet.

### 6. Supporting Framework

(a) Supports shall be pipe or angle irons with fittings for wall, floor or ceiling braces. The dimensions of the supports shall be as specified on requisite sheet.

(b) Fittings for wall, floor or ceiling braces to be furnished as specified on requisite sheet.

### 9. Dielectric Requirements

(e) Panels shall be capable of standing a potential stress to be applied between live terminals and between live terminals and frame in accordance with A.I.E.E. standards.

### 10. Finish

(a) Metal parts of instruments and trimmings on front of switchboard shall be as specified on requisite sheet.

(d) Handles shall be stained black with insulating paint or varnish.

### 11. Card Holders

(a) Card holders shall be furnished for switches, circuit breakers and rheostats, as specified on requisite sheet.

(b) Card holders shall be mounted where they will best indicate the circuits controlled, and shall be securely fastened with escutcheon pins or screws of non-corrosive metal.

(c) Card holders shall be of non-corrosive metal.

### 12. Copper Connections and Terminals

(b) Unless continuously supported, main current carrying connections shall not be smaller than No. 6 A.W.G. and shall be of sufficient mechanical strength to withstand bending between supports.

(d) Separate terminal lugs shall be provided for each wire or cable connection leading from the switchboard.

### 13. Instruments

(a) Electrical measuring instruments shall be so damped that indicating device will come quickly to rest with each change in the indicated value.

(b) Indicating electrical measuring devices and their transformers shall be calibrated with careful consideration of possible electrical interference from circuits and other apparatus. The error expressed in terms of percentage of full scale shall not exceed 1 per cent, when used without current or potential transformers; 1½ per cent, with either one or the other; and 2 per cent, when used with both potential and current transformer.*

*The values expressed in 13-b are exclusive of the error in the instrument transformers.

### 14. Instrument Transformers

(a) Transformers shall be capable of carrying their regular full secondary load continuously in accordance with A.I.E.E. standards.

(b) They shall withstand without injury a temperature of 95 degrees C., 203 degrees F.

(c) Windings of instrument transformers shall be insulated to withstand without injury alternating current voltages in accordance with A.I.E.E. standards.

(d) Current transformers:

1. Current transformers shall withstand double full rated current for 5 min. without injury.

2. They shall have such ratios as to obtain 5 amp. in the secondary circuits when carrying full rated current.

(e) Potential transformers shall have such ratios as to obtain approximately 110 volts on secondary at rated normal voltage.

### 15. Fuses

(a) Fuses shall be furnished in circuits and of the capacity shown on purchaser's wiring diagram, or as specified on requisite sheet.

(b) They shall be in accordance with drawing 1309.

### 16. Knife Switches

(b) They shall be so constructed that the temperature rise at contacts or on any part when carrying full rated current shall not exceed 30 degrees C., 86 degrees F., above the surrounding air, based on a room temperature of 40 degrees C., 104 degrees F.

(c) Knife switches shall be in accordance with manufacturers' standard or as specified on requisite sheet.

### 17. Circuit-Breakers

(a) The maximum observable temperature rise of the various parts of the circuit-breakers shall not exceed the following limits when the ambient temperature of reference is 40 degrees C., 104 degrees F., contacts in air when clean and bright, 30 degrees C., 86 degrees F., contacts in oil, 30 degrees C., 86 degrees F., oil, 40 degrees C., 104 degrees F.; potential coils unimpregnated or not immersed in oil, 35 degrees C., 95 degrees F.; series coils unimpregnated or not immersed in oil, 50 degrees C., 122 degrees F.; series of potential coils impregnated or immersed in oil, 50 degrees C., 122 degrees F.; coils, if bare or if insulation is of asbestos, mica or similar heat resisting material, 70 degrees C., 158 degrees F. All other parts, 70 degrees C., 158 degrees F.

(b) The operating mechanism of remote electrically controlled circuit-breakers shall operate at any voltage between 70 and 140 volts d.c. for 125-volt solenoids, and between 140 and 280 volts for 250-volt d.c. solenoids, and shall be provided with auxiliary attachment for hand operation.

(c) Air circuit-breakers:

1. Air circuit-breakers shall be of carbon break type.

2. The trip coils of overload and underload circuit-breakers shall be provided with a calibrating device which can be easily adjusted; the calibrating scale shall be plainly visible.

(d) Oil circuit-breakers.

1. Breakers shall be capable of opening twice in succession, with two minute intervals, any circuit within its guaranteed rupturing capacity and still be in condition to be closed and carry its rated current continuously as a non-automatic breaker.

2. Oil circuit breakers shall either have their phases in separate compartments or separated by insulating barriers so as to give protection against cross-arcing.

3. Cell mounted oil breakers designed for 11,000 volts or over shall be furnished with slate or soapstone slab if required.

4. Tank type oil breakers designed for 22,000 volts or over shall be furnished with boiler iron tanks and all live parts so insulated therefrom that no protecting structure is necessary.

### 18. Disconnecting Switches

(a) Disconnecting switches shall be of knife type, equipped with suitable terminals, with hole or ring in blade so as to permit of operation by means of insulated rod with hook.

(b) For circuits up to and including 2500 volts they shall be mounted on marble bases; for higher voltage circuits they shall be mounted on wet process porcelain insulators, suitable for the voltage, the insulation in turn to be mounted on metal bases or framework as may be required.

(c) They shall have such current carrying capacity as to carry the rated current continuously without the temperature of any part rising more than 30 degrees C., 86 degrees F., above the surrounding air, based on a room temperature of 40 degrees C., 104 degrees F.

### 19. Lightning Arresters

(a) Lightning arresters, if required, shall be designed to protect apparatus connected to the circuit from the destructive effects of lightning disturbances. Type, location and number to be shown on requisite sheet.

### 20. Name-Plates

(a) A name-plate showing manufacturer's name and serial number shall be furnished on each panel.

(b) Name-plate shall be of non-corrosive metal and securely fastened with screws or pins of non-corrosive metal.

Committee: C. H. Morrison (N. Y. N. H. & H.), chairman; W. M. Vandersluis (I. C.), vice-chairman; F. J. Ackerman (K. C. T.), B. T. Anderson (D. L. & W.), J. A. Beoddy (N. & W.), G. S. Davis (P. & R.), W. F. Follett (N. Y. N. H. & H.), C. E. Goings (P. R. R.), E. C. Grant (U. P.), J. C. Mill (C. M. & St. P.), W. Morrison (N. Y. C.), R. M. Phinney (C. & N. W.), F. C. Stuart (E. J. & E.), G. K. Thomas (A. T. & S. F.), L. F. Vieillard (L. I.), L. C. Walters (Southern), F. E. Wass (N. Y. C.), Edgar Winans (A. T. & S. F.), Leroy Wyant (C. R. I. & P.).

## Discussion

C. H. Morrison (chairman): The specification submitted is a revision of that already in the Manual, bringing the details up to date, and having the specification comply with unit specifications passed by the association and included in the Manual. Therefore I would like to dispense with calling each paragraph, and after calling attention to several corrections in the specification, would move that it be submitted to the annual meeting, to be voted on by letter ballot, and included in the Manual.

In Section 4, Drawings, after the words "purchaser desires" add the words "to furnish." The committee recommends that the specifications for alternating current, automatic block signal system, be approved and submitted at the annual meeting for submission to letter ballot and inclusion in the Manual, eliminating the following specifications: Revised specifications and requisites for apparatus and material for a. c. block signal system on railroads using a. c. propulsion, with specifications and requisites; for apparatus and material for a. c. block signal system on roads using d. c. propulsion, and specifications and requisites for apparatus and material for a. c. block signal system on railroads using other than a. c. or d. c. propulsion.

(Motion seconded and carried.)

Mr. Morrison: The committee recommends that the specification for air cooled reactors for line and track circuit as provided, be approved, and take the usual course.

(Motion seconded and carried.)

Mr. Morrison: The committee submits the following change in the specification for resisters for line and track service. In 5, Name-Plate: "Each resister shall bear a metal name-plate, and paster or tag, showing" the various items are lettered. They should be numbered. Part (2) should read "Manufacturers' drawing and other reference number." The committee recommends that the specification as revised be approved and take the usual course.

(Motion seconded and carried.)

Mr. Morrison: The following change should be made in section 15. Fuses. (b) "They shall be in accordance with R. S. A. 1309, or as specified on requisite sheet."

The committee recommends that the specification be accepted and take the usual course.

(Motion seconded and carried.)

The committee was dismissed with the thanks of the association.

# Report of Committee XIII—Electrical Testing

UNDER THE ASSIGNMENT to prepare tables of standard ranges and scales for electrical testing instruments the committee revised drawing 1378 and prepared tables of standard ranges and scales for portable a.c. voltmeters and ammeters. The title on drawing 1378 was changed to read "Scale ranges for d.c. Volt-Ammeters" and the committee recommended its approval for submission to letter ballot for inclusion in the Manual.

TABLES OF STANDARD RANGES AND SCALES FOR ALTERNATING CURRENT VOLTMETERS

| Ranges: Combination No. | Ranges: Volts | Scale: Min. Length of Upper Arc | Scale: Divs. | Scale: No. of Blocks | Scale: Div. per Block | Range of Reading, Volts | |
|---|---|---|---|---|---|---|---|
| 1. (a) | 0— 0.5<br>0— 2.0<br>0— 5.0<br>0— 20.0 | 4½″ | 100 | 10 | 10 | 0.1 | to 20.0<br>1920. |
| (b) | 0— 0.5<br>0— 2.0<br>0— 5.0<br>0— 20.0 | 2½″ | 50 | 5 | 10 | 0.1 | to 20.0<br>1920. |
| 2. (a) | 0— 60.<br>0—120.<br>0—240. | 4½″ | 120 | 12 | 10 | 12.0 | to 240<br>1920. |
| (b) | 0— 60.<br>0—120.<br>0—240. | 2½″ | 60 | 6 | 10 | 12.0 | to 240<br>**1920.** |
| 3. (a) | 0— 1.<br>0— 5.<br>0— 25.<br>**0—125.** | 2½″ | 50 | 5 | 10 | 0.2 | to 125<br>1920. |

**The committee recommended that the table of Standard Ranges and Scales for Alternating Current Voltmeters be accepted for submission to letter ballot for inclusion in the Manual.**

TABLE OF STANDARD RANGES AND SCALES FOR SINGLE RANGE ALTERNATING CURRENT AMMETERS

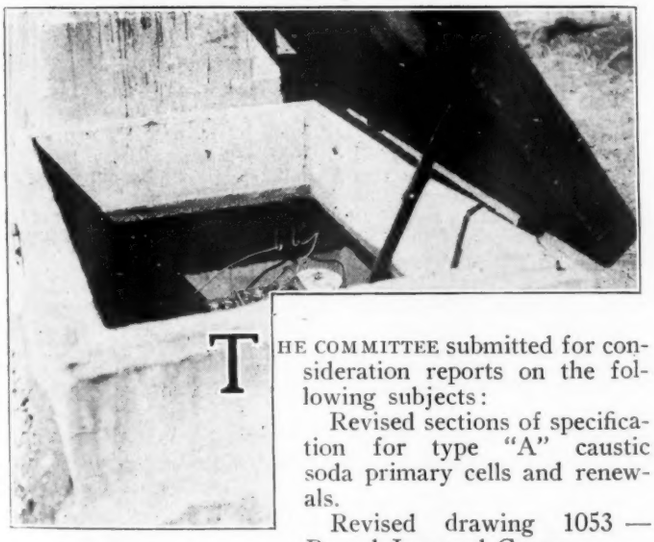
| Ranges: No. | Ranges: Amperes | Scale: Min. Length of Upper Arc | Scale: Divs. | Scale: No. of Blocks | Scale: Div. per Block | Range of Reading, Amperes | |
|---|---|---|---|---|---|---|---|
| 1. (a) | 0— .150 | 5″ | 150 | 15 | 10 | .040 | to .150 |
| (b) | 0— .150 | 2½″ | 75 | 7½″ | 10 | .040 | to .150<br>1920. |
| 2. (a) | 0— .500 | 5″ | 100 | 10 | 10 | .100 | to .500 |
| (b) | 0— .500 | 2½″ | 50 | 5 | 10 | .100 | to .500<br>1920. |
| 3. (a) | 0— 2.00 | 5″ | 100 | 10 | 10 | .400 | to 2.00 |
| (b) | 0— 2.00 | 2½″ | 50 | 5 | 10 | .400 | to 2.00<br>1920. |
| 4. (a) | 0— 5.00 | 5″ | 100 | 10 | 10 | 1.00 | to 5.00 |
| (b) | 0— 5.00 | 2½″ | 50 | 5 | 10 | 1.00 | to 5.00<br>1920. |
| 5. (a) | 0— 15.00 | 5″ | 150 | 15 | 10 | 4.00 | to 15.00 |
| (b) | 0— 15.00 | 2½″ | 75 | 7½″ | 10 | 4.00 | to 15.00<br>1920. |
| 6. (a) | 0— 50.00 | 5″ | 100 | 10 | 10 | 10.00 | to 50.00 |
| (b) | 0— 50.00 | 2½″ | 50 | 5 | 10 | 10.00 | to 50.00<br>1920. |
| 7. (a) | 0—100.00 | 5″ | 100 | 10 | 10 | 20.00 | to 100.00 |
| (b) | 0—100.00 | 2½″ | 50 | 5 | 10 | 20.00 | to 100.00<br>1920. |

**The committee recommended that the Table of Standard Ranges and Scales for Single Range Alternating Current Ammeters be accepted for submission to letter ballot for inclusion in the Manual.**

Committee: P. M. Gault (I. C.), chairman; J. S. Gensheimer (N. Y. P. & N.), vice-chairman; Harry Coombs (L. E. & W.), C. E. Earhart (A. & V.), Thos. Holt (C. U. D. Co.), E. E. Ireland (C. I. & L.), Malcolm McIntyre (M. C.), F. D. Morehart (C. M. & St. P.), J. P. Muller (Southern), T. J. O'Meara (N. Y. C.), D. W. Rosenweig (Sunset Lines), C. O. Seifert (B. & O. C. T.), E. B. Smith (N. Y. C.), L. L. Whitcomb (N. Y. C.).

(These tables were accepted after brief discussion.)

# Report of Committee XI—Batteries



THE COMMITTEE submitted for consideration reports on the following subjects:

Revised sections of specification for type "A" caustic soda primary cells and renewals.

Revised drawing 1053 — Round Jars and Covers.

New drawing 1419—Rectangular Jars and Covers.

Revised specification for concrete battery box.

Revised specification for lead type portable storage battery for signaling.

Drawings 1053 and 1419 were prepared in conference with the jar manufacturers and the requirements in some places are a trifle more severe than is recommended by them. Certain limitations are necessary in order to make the jars sufficiently uniform to meet the criticisms of the battery manufacturers and to make them serviceable for the railroads. The rectangular jars have been particularly objected to by the manufacturers, due to the difficulty in getting heat resisting glass into this shape. The drawings were submitted for discussion.

Certain sections of the primary cell specification were revised in line with the discussion at the December meeting and were tentatively submitted for further discussion.

In accordance with instructions, the committee submitted a revised specification for a concrete battery box. The requirements of this specification are similar to those of the earlier specification which has been in successful commercial use for several years. Sections were added to provide for wood lining for primary battery use. Standard clauses have been revised. This specification was submitted for discussion.

The specification for portable lead type storage battery for signaling was revised by the committee working in conjunction with the representatives of the manufacturers and in conference with the representatives of the majority of roads using this type of battery.

The committee recommended that the specifications for lead type portable storage battery for signaling be submitted to letter ballot at the annual meeting for inclusion in the Manual.

## Specifications for Lead Type Portable Storage Battery for Signaling

### 1. DESIGNATION

(a) In ordering cells or parts, the capacity required shall be designated as "50 ampere hour," "75 ampere hour," or "100 ampere hour." 1920.

(b) These terms shall signify the ampere hour capacity on a 72-hr. test of cells to be furnished under these specifications. 1920.

### 2. DIMENSIONS

(a) General dimensions shall be as follows:

| Capacity | Number of Cells | Inside Length of Case in Inches | Inside Length of Jar in Inches | Approx. Weight in Lb. |
|---|---|---|---|---|
| 50 | 1 | 2 3/4 | 2 7/16 | 12 |
| | 2 | 5 1/16 | " | 27 |
| | 3 | 8 5/8 | " | 40 |
| | 4 | 11 5/8 | " | 53 |
| 75 | 1 | 3 7/8 | 3 9/16 | 20 |
| | 2 | 7 15/16 | " | 40 |
| | 3 | 12 | " | 60 |
| | 4 | 12 1/8 | " | 80 |
| 100 | 1 | 5 | 4 11/16 | 27 |
| | 2 | 10 3/16 | " | 24 |
| | 3 | 15 3/8 | " | 81 |

1920.

(b) Jars shall be 5 15/16-in. wide and 7⅜-in. high. 1920.

### 3. Elements

(a) The plates shall be connected into positive and negative groups by burning to lead alloy pillar straps. 1916.
(b) The positive and negative plates shall be of pasted type approximately 5-in. high by 5¾-in. wide. Positive grids shall be made of six to eight per cent antimony alloy; negative grids shall be made of four to eight per cent antimony alloy. 1920.
(c) Positive plates shall be not less than ¼-in. thick. Intermediate negative plates shall be not less than 3/16-in. thick. End negative plates shall be not less than 3/32-in. thick. 1920.
(d) Positive and negative groups, when furnished separately, shall be ready for service after an initial charge of one ampere per positive plate continued for 100 hrs. 1920.
(e) Plates shall be burned to pillar straps not less than ¼-in. thick on 1⅛-in. centers. Pillar post shall be so constructed as to prevent creeping of electrolyte. 1920.
(f) Plates shall be so supported by pillar strap and so surfaced on bottom that all plates shall rest on all supporting ribs. 1920.
(g) Plate lugs shall be not less than ¾-in. wide and of same thickness as the plate. 1920.

### 4. Separators

(a) Adjacent plates shall be separated by a sheet of hard rubber and a sheet of treated wood. 1916.
(b) The wood sheet shall be at least 9/32 in. thick and grooved on one side. The web shall be not over 1/16 in. thick. The rubber sheet shall be perforated and shall be at least 1/64 in. thick. 1920.
(c) The flat side of wood sheet shall be placed against the negative plate. The rubber sheet shall be placed against the positive plate. 1920.

### 5. Electrolyte

(a) Electrolyte shall be of 1,220 specific gravity, unless otherwise specified, and shall be in accordance with R. S. A. specification for "Electrolyte for Lead Type Storage Battery." 1920.

### 6. Jars

(a) The jars shall be of hard rubber compound, free from metallic substances, soft spots or flaws. 1920.
(b) The wall of the jar shall be of a uniform thickness not less than 7/64 in. and shall have 1/64 in. draft in each wall, between the top of the jar and the top of the ribs. The variation in outside dimensions shall be not greater than 1/64 in. The corners shall be uniform and as sharp as consistent with strength. The top shall be ground evenly and parallel with bottom of jar. 1920.
(c) The bottom of the jar shall be reinforced around edges and with at least one intermediate reinforcement. The ribs for support of plates shall be ¾ in. high, not less than 7/64 in. thick at the top and shall be of a harder compound than the jar walls. 1920.
(d) The jars when supported in the case shall withstand an increase in temperature of the electrolyte to 150 degrees F. without distortion. 1916.
(e) Compound from which jars are made shall, when tested at 70 degrees F., have a tensile strength of not less than 4000 lb. per sq. in. and an elongation of not less than 5 per cent. In all cases the product of the tensile strength in pounds and the elongation in percentage shall be not less than 30,000. 1920.

### 7. Jar Covers

(a) Rubber compound from which covers are made shall have a tensile strength of not less than 2400 lb. 1920.
(b) Holes for pillar posts shall be 3¼-in. center to center. 1920.

### 8. Vents

The vent hole in cover shall be at least ⅞ in. in diameter and shall be provided with a removable screw or bayonet catch cap, so vented that gas will readily escape without carrying entrained electrolyte. 1920.

### 9. Terminals and Connections

(a) Unless otherwise specified, end cells of battery shall be equipped with lead alloy terminal posts, with a detachable non-turning binding post in accordance with R. S. A. 1070. 1920.
(b) Unless otherwise specified, cell connections shall be of lead alloy burned to pillar posts. 1920.
(c) When wire connections are specified they shall be of No. 6 A.W.G. soft drawn bare tinned copper, securely cast in pillar post, and extending 3½ in. above post. The top of pillar post shall be rounded. 1920.

### 10. Case

(a) The case shall be made of well-seasoned oak, maple, beech, birch or ash and shall be 6¼ in. wide inside. 1920.
(b) The sides and ends shall be at least ⅝ in. thick with horizontal grain and shall be fastened together by dovetail or lock corners. The sides shall be fastened to the bottom with 1¼-in. No. 8 flat head screws. 1920.
(c) The bottom shall be at least ⅝ in. thick and top of case shall be even with top of jar. 1920.
(d) A band iron strap 1-in. by 3/32-in. shall extend down the ends and across the bottom. The strap shall be flush with the bottom only, fastened to the ends with flat head wood screws and drilled near top to receive the hooked end of bail. 1920.
(e) Cases for 4 cells shall be provided with 3/16-in. bolt to hold sides together. Bolt head and nut shall be countersunk flush with outside surface of case. 1920.

### 11. Case Covers

(a) The top of case cover shall be at least ½ in. thick and shall be fastened to the cover sides and ends, with 1¼-in. No. 8 flat head screws. The sides and ends of the case cover shall be ⅝ in. thick. 1920.
(b) The case cover shall have disconnecting hinge and be provided with clasps to hold the cover in place. 1920.
(c) The case cover shall be provided with ½-in. notch, for wire connection, located on front side, opposite terminal. 1920.

### 12. Case Handle

(a) Case shall be provided with a handle which shall consist of a forged, mild steel bail, 5/16 in. in diameter, and a handle of well-seasoned maple, ash, oak or beech 1¼ in. in diameter, extending the full length of the case, with a ferrule on each end. 1920.

### 13. Painting

(a) Case, case cover, handle, and packing boards shall be protected with two coats of acid-proof paint applied by dipping. 1920.

### 14. Sealing Compound

(a) The sealing compound shall be of such composition as not to have an injurious effect on the battery. 1916.
(b) The sealing compound shall not be brittle at 25 degrees F. below zero, and shall not run at 150 degrees F. 1920.

### 15. Assembly

(a) Unless otherwise specified, the cells shall be assembled in wood carrying cases and shall be given the full initial charge before shipment. 1920.
(b) Jars shall be placed in case with wood packing boards at least ¼-in. thick between adjacent jars. 1920.

### 16. Inspection

The four paragraphs, a, b, c and d, consist of standard sections.

### 17. Tests

The first three paragraphs, a, b and c, consist of standard sections. Paragraph d follows:
(d) Cells when tested shall be fully charged and then discharged as follows:
1. Starting at noon, with a room and solution temperature of 80 degrees F., and maintaining a room temperature of 80 degrees F. throughout test, battery shall be discharged at 1/25 of the rated ampere hour capacity for 5 hrs., followed by a rest of 16 hr., then discharged at same rate for 8 hr. with another rest of 16 hr., then discharged 8 hr. at same rate, rested 16 hr. and then discharged at same rate, until 95 per cent of the rated capacity has been discharged, when voltage shall be not less than 1.75 volts per cell. 1920.

### 18. Packing

(a) Material shall be so prepared as to permit convenient handling and to protect against loss or damage during shipment. (S. S. 8-a.) 1919.
(b) When ordered unassembled, wood separators shall be packed in air-tight metal containers holding 200 each. Rubber separators shall be packed 200 in a package. The positive and negative groups shall be packed separately, as fol-

lows: 20—50 a.h. groups; 16—75 a.h. groups or 10—100 a.h. groups in a package. 1920.

19. MARKING

This consists of three paragraphs, a, b and c, which are standard sections.

Committee: R. B. Ellsworth (N. Y. C.), chairman; A. B. Himes (B. & O.), vice-chairman; A. R. Fugina (L. & N.), J. G. Bartell (L. V.), P. A. Bliss (S. P.), W. E. Boland (S. P.), J. F. Jacobs (C. R. R. of N. J.), T. L. Johnson (D. L. & W.), A. H. McKeen (O. W. R. R. & N.), H. G. Morgan (I. C.), S. U. Rhymer (C. & A.), J. C. Seaman (N. Y. C.), Warren Y. Scott (B. & M.), F. C. Timmons (D. & H.), E. L. Watson (P. R. R.), A. H. Yocum (P. & R.).

**Discussion**

F. P. Patenall (B. & O.): In preparing the new clauses of specification for type "A" caustic soda primary cells and renewals, were the manufacturers in conference with the committee?

R. B. Elsworth (Chairman): The committee has been working closely with the manufacturers, and since the December meeting it has discussed the specifications in conference with various representatives, but it did not hold a formal meeting.

R. W. Erwin (National Carbon Company): An intermittent test of some sort is a great improvement over other tests. The function of the intermittent test is to give an idea of what the minimum voltage will be in operating a signal motor. It is a question whether the test as now conducted will accomplish the results desired. The main criticism of this test is making a complicated intermittent one without getting exactly the conditions wanted. The result desired is to find out what the voltage will be in actual service. That voltage is bound to be higher than it would be at a three ampere continuous discharge.

E. B. Smith (N. Y. C.).: Did the committee in the last part of paragraph (a) refer to Fahrenheit or Centigrade temperature?

Mr. Elsworth: We have tried to make the test intermittent to meet objections to the continuous test, and the three ampere discharge for the 10 periods of 30 sec. each was particularly designed for those who wish to use this type of battery to operate a low voltage switch machine.

Following the discussion on Specification for Type "A" Caustic Soda Primary Cells and Renewals, the committee submitted Specification for Concrete Battery Box.

T. S. Stevens (A. T. & S. F.): Has the committee considered the actual necessity of specifying steel rods for concrete battery boxes? We are doing all our work with netting.

Mr. Elsworth: Mr. Stevens, have any of these boxes been submitted to the test, as outlined in the specification?

R. L. Woodling (A. T. & S. F.): I have filled 60 cell boxes reinforced with chicken wire, with crushed rock or sand, and picked them up with the crane without any chain under them, with channel iron across the top, and swung them out and unloaded them without breaking.

Larsen Brown (A. T. & S. F.): I wonder if the committee considered using pressed steel covers? They are cheaper and easier to handle.

A. B. Du Bray (I. C. C.): The hinges on wooden covers are frequently out of order, and the covers also; whereas the sheet metal covers do not need hinges and are easily handled and stand up very much better in use.

H. G. Morgan (I. C.): A hinge would be necessary on a large cover even using pressed steel.

Mr. Elsworth: The committee will take this question up with the manufacturers and report in July.

Mr. Patenall: Can the chairman of the committee tell us as to the cost of the rectangular jar compared with the cylindrical jar of smaller capacity?

Mr. Elsworth: The barrel-shaped jar costs $12.

A. B. Himes (Vice-Chairman): Presented specification for Lead Type Portable Storage Battery for Signaling. There are some typographical errors in 2, which will be corrected.

G. W. Vinal (Bureau of Standards): In 5, Electrolyte shall be of 1220 specific gravity. That, of course, is an ideal figure which is not always realized in practice. Would it not be well to say: The electrolyte shall be of not more than 1220 specific gravity? I would also suggest that the temperature at which this specific gravity should be measured should be specified.

Mr. Himes: There are locations where we cannot adhere to the 1220, as in the extreme north. We do not want to set a maximum, but wish to allow leeway for errors in cold territory.

Mr. Wiegand: I would like to suggest a revision of 3 (a) to read: "The plates shall be connected into positive and negative groups by burning to pillar straps on 1⅛-in. centers, and 3 (e) to read: Pillar straps shall be of lead alloy not less than ¼ in. thick. Pillar post shall be so constructed as to prevent creeping of electrolyte."

Mr. Vinal: Would it not be well to insert in 14 that the sealing compound should adhere firmly to both rubber and wood surfaces?

Mr. Elsworth: The committee will consider that.

The committee was dismissed with the thanks of the association.

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## Committee of Direction Meets

The Committee of Direction of the Signal division will hold a meeting in the French Room of the Congress Hotel at 8:30 p. m. The purpose of this meeting is to finish such uncompleted business as it was unable to complete at the all-day meeting held on Sunday, March 14.

## A Bolivian Visitor

Colonel T. P. Ledwidge, chief engineer of the Ferro Carril de Bolivia, with headquarters at Potosi, Bolivia, is a visitor at the convention of the American Railway Engineering Association. He was present at the sessions yesterday and was much impressed with the contrast between American railway practices and those in his country. Colonel Ledwidge is a graduate of Cornell University who went to Bolivia with Grace & Co. 21 years ago. As an executive officer of a government-owned road, he is an officer in the army with all the privileges and rights of that position. Colonel Ledwidge is in this country to interest American financiers in railway opportunities in Bolivia and also to secure new equipment.

Prior to the war the railway materials used in Bolivia were imported primarily from Europe, but that country is now dependent on the United States for its supplies. Those American materials which have been delivered are meeting with much favor, and America is now looked on as the logical field for railway equipment because of its accessibility and the favor with which American designs are received. At the present time American representatives are calling at the railway centers in western South America at intervals, although most of the purchases are made through the medium of representatives in the United States. Colonel Ledwidge is advocating a joint purchasing commission for the railways on the west coast of South America, believing that such an arrangement will not only result in economy to the roads, but will promote standardization, a thing much needed in those countries.

# Signal Division Registration

THE REGISTRATION AT THE TUESDAY or second day sessions of the Signal Division of the American Railroad Association are given below. Including the registration of yesterday, a total of 290 active and 125 affiliate members, or a grand total of 415, registered. This compares with a total registration of 318 last year and 198 in 1918.

### Active Members

Annear, R. F., Sig. Supvr., C. R. I. & P. Ry.
Baines, W. H., Sig. Supvr., Mo. Pac. R. R.
Boyce, Geo., Supt. Tele. & Sigs., C. St. P., M. & O. Ry.
Buchanen, F. H., Sig. Engr., Penn. Lines, Pittsburgh, Pa.
Case, D. M., Sig. & Elec. Eng., Lines West, Southern Ry.
Cooper, H. H., Sig. Insptr., N. Y. C. Lines, Buffalo.
Diffenbaugh, F. R., Sig. Dept., A. T. & S. F. Ry.
Eck, W. J., Supt. Sig. & Elec. Dept., Sou. Ry. System.
Elliott, W. H., Sig. Engr., N. Y. C. Line, Albany, N. Y.
Ellis, G. E., Consultg. Engr.
Ferguson, J. G., Supvr. Signals, N. & W. Ry.
Galleher, J. M., Sig. Supvr., Erie R. R.
Gollos, Anstol, Elec. Engr., Chicago Un. Sta. Co.
Hanson, E., Sig. Engr., G. C. & S. F. Ry.
Hanson, L. J., Supvr. Sigs., G. T. R. R.
Hickman, J. Sig. Supvr., M. K. & T. Ry.
Hoag, H. F., Sig. Engr., K. C. S. Ry.
Hovey, J. P., Sig. Engr., I. C. C., Chicago.
Huber, G. W., Tele. & Sig. Dept., C. G. W. Ry.
Hutchinson, F. V., Office Engr., M. K. & T. Ry.
Inland, E. E., Sig. Insptr., C. I. & L.
Kelly, Arthur J., Supvr. Sigls., C. C. C. & St. L. R. R.
Marcum, J. L., Sig. Supvr., Mo. Pac.
Martin, W. P., Sig. Insptr., I. C. Ry.
Mill, J. C., Sig. Engr., C. M. & St. P. Ry.
Muller, J. P., Sig. & Elec. Supvr., Sou. Ry.
Oppelt, J. H., Supvr. Sigs., N. Y. C. & St. L. R. R.
Penrod, A. J., Jr., Sig. Supvr., B. & O. R. R.
Pollack, O. A., Roadmaster, A. T. & S. F., Coast Line.
Punter, W. M., Sig. Engr., C. N. Ry., Toronto.
Rice, D. S., Supvr. Sigs., L. V. R. R.
Scott, H. S., Supvr. Sigs., I. C. R. R.
Sova, H. M., Asst. Sig. Supvr., N. P.
Stevens, Thos. S., Sig. Engr., A. T. & S. F. Ry.
Swenson, T. W., Supvr., P. R. R.
Unger, O. R., Sig. Insptr., Mo. Pac. Ry.
Van Hagan, Prof. Leslie F., University of Wisconsin.
Vinal, Geo. W., Bureau of Standards, Washington, D. C.
Wright, John T., Asst. Supvr. Sigs., G. T. R. R.
Wyley, E., Sig. Supvr., C. B. & Q. R. R.
Zahnen, J. P., Asst. Sig. Supvr., C. R. I. & P. Ry.
Zoetman, C. E., Div. Engr., P. R. R., Wilmington, Del.

### Affiliate Members

Ahrens, C. R., Act. Eastern Rep., Chicago Ry. Sig. & Supply Co., New York.
Allen, L. W., Salesman, Hazard Mfg. Co., New York.
Ames, Azel, Kerite Insulated Wire Co.
Anderson, Alex. S., Rep., Adams & Westlake Co., Chicago.
Arkenburgh, W. H., Salesman, Canadian National Carbon Co., Ltd., Schenectady, N. Y.
Baker, Ray N., Rep., Central Electric Co., Chicago.
Beall, Charles R., Elec. Engr., Union Switch & Signal Co., Swissvale, Pa.
Beck, H. M., Engr., Electric Storage Battery Co., Chicago.
Bennett, C. L., Page Steel & Wire Co.
Bleecker, Wm. H., Page Steel & Wire.
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Brown, E. W., Salesman, Thos. A. Edison, Inc., Primary Battery Div., East Orange, N. J.
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Cameron, F. C., Rep., Corning Glass Works, Corning, N. Y.
Camp, W. M., Railway Review, Chicago.
Carradson, P. H., Galena Sig. Oil Co., Franklin, Pa.
Carter, A. T., Chief Engr., Federal Signal Co.
Carter, E. Kemper, Standard Asphalt & Rfg. Co.
Cobb, E. B., Chemist, Standard Oil Co., New York, N. Y.
Coleman, J. P., Cons. Engr., Union Switch & Sig. Co., Swissvale, Pa.
Coleman, W. W., Coleman Ry. Supply Co., New York, N. Y.
Condit, E. A., Jr., Gen. Sales Agt., The Rail Joint Co., New York, N. Y.
Cox, R. J., Rep., Ry. Sig. and Tel. Depts., National Carbon Co., Louisville, Ky.
Creegan, Jr., James R., Signal Accessories, New York.
Day, S. M., Gen. Ry. Signal Co., Rochester, N. Y.
Dean, A., Jr., Spec. Rep., Union Switch & Signal Co., New York, N. Y.
Dodgson, F. L., Cons. Engr., General Railway Signal Co., Rochester, N. Y.
Downs, Loren N., Pres., United Electric Apparatus Co., Boston, Mass.
Dressel, F. W., Pres., Dressel Railway Lamp Works, New York, N. Y.
Edmunds, F. W., Sunbeam Elec. Mfg. Co., New York.
Erwin, R. W., National Carbon Co.
Fitz Gerald, J. M., the Gerald Co.
Flood, E. J., Page Steel & Wire Co.
Fox, M. J., Rep., Railroad Supply Co., Chicago.
Garrity, P. A., Salesman, Thos. A. Edison, Inc., Primary Battery Div., Chicago.
Geneser, J. A., Office Engr., General Railway Supply Co., Chicago.
Gillingham, W. J., Jr., Vice-Pres., Hall Switch & Signal Co., Garwood, N. J.
Gilman, Chas., East. Mgr., C. F. Massey Co., New York.
Gort, Godfrey, Rep., L. S. Brach Supply Co., Newark, N. J.
Graber, Geo. A., Rep., Kerite Ins. Wire & Cable Co., Chicago.
Graves, C. B., Sales Mgr., Federal Elec. Co., Chicago.
Grebbins, J. F., Bryant Zinc Co.
Green, D. H., Natl. Carbon Co., Cleveland, Ohio.
Griffin, H. W., Engr., Union Switch & Signal Co., New York.
Hackett, J. W., The Okonite Co.
Henry, W. S., Service Engr., General Railway Signal Co., Rochester, N. Y.
Henze, C. D. A., Res., Mgr., Federal Signal Co., Chicago.
Hobson, J. S., Western Mgr., Union Switch & Signal Co., Chicago.
Holden, A. C., Guest General Ry. Sig. Co.
Hollister, H. L., Sig. Engr., Hall Switch & Signal Co., Garwood, N. J.
Hoskinson, H. S., Sec., Dressel Ry. Lamp Works, New York.
Hough, S. J., Rep., Waterbury Battery Co., New York, N. Y.
Howard, L. Frederic, Chief Engr., Union Switch & Signal Co., Swissvale, Pa.
Howe, W. K., Chief Engr., General Railway Signal Co., Rochester, N. Y.
Hudson, E. E., Vice-Pres. & Gen. Mgr., Waterbury Battery Co., New York, N. Y.
Hunt, H. E., Engr., Electric Storage Battery Co., Philadelphia, Pa.
Hyde, P. B., Hyde Battery Co., Chicago.
Jacobs, Harry M., Sig. Accessory Dept., General Electric Co., Schenectady, N. Y.
Johnson, Sidney, Vice-Pres., General Ry. Sig. Co., New York, N. Y.
Jones, Fred H., Hyde Battery Co., Chicago.
Keefe, T. A., Salesman, Hazard Mfg. Co., Pittsburgh, Pa.
Keenan, W. J., Vice-Pres., Pittingell Andrews Co., Boston, Mass.
Kellenberger, K. E., Editor Railway Signal Engineer, Chicago.
Kircher, Paul, Massey Concrete Products Corp., Chicago.
Kyle, W. T., Sales Agt., Page Steel & Wire Co., New York, N. Y.
La Barge, H. S., Handlan-Buck Mfg. Co., St. Louis, Mo.
Lepreau, F. S., Macbeth Evans Glass Co.
Lorenz, J. M., Salesman, Central Electric Co., Chicago, Ill.
Lundy, E. A., Rep. Simmonds-Boardman, Pub. Co., Chicago.
McCarthy, D. J., Ch. Engr., Chicago Ry. Sig. & Supply Co., Carpentersville, Ill.
McChesney, Leonard, Asst. Gen. Mgr., Thos. A. Edison, Inc., Orange, N. J.
McCready, Harold, Office Mgr., Union Switch & Signal Co., New York, N. Y.
McCune, C. A., Page Steel & Wire Co.
McNeal, A. L., Central Elec. Co., Chicago.
Mann, L. R., Central Elec. Co., St. Louis.
Manson, W. L., American Hoist & Derrick Co., St. Paul, Minn.
Manuel, W. N., Rep., Corning Glass Works, Corning, N. Y.
Meisel, B. W., Asst. Editor, Railway Signal Engr., Chicago.
Miller, P. W., Rep., Kerite Ins. Wire & Cable Co., New York, N. Y.
Morris, D. R., Sales Engr., Federal Signal Co., New York, N. Y.
Moscrip, A. L., France Stone Co., Toledo, Ohio.
Nelson, G. A., Spec. Rep., Waterbury Battery Co., New York, N. Y.
Neubert, Walter P., Mech. Engr., Union Switch & Signal Co., Swissvale, Pa.
Newcomb, E. W., Pacific Coast Rep., Thos. A. Edison, Inc., Primary Battery Div., San Francisco, Cal.
Newman, H. G., Johns-Manville Co.

Ogle, E. L., Federal Elec. Co., Chicago.
Pendorf, P. G., National Carbon Co.
Pflasterer, C. S., Ry. Signal & Tel. Depts., National Carbon Co., Cleveland, Ohio.
Pratt, Alfred E., Sales Dept., National Carbon Co., Cleveland, Ohio.
Reichard, W. H., Asst. Gen. Mgr., Federal Signal Co., Albany, N.Y.
Renton, Jos. A., Kerite Ins. Wire & Cable Co., New York, N. Y.
Rhoades, L. R., National Carbon Co.
Saunders, J. E., Asst. Chief Engr., Union Switch & Signal Co., Swissvale, Pa.
Scheman, C. H., Canadian-Chicago Bridge & Iron Co., Montreal.
Schermerhorn, E. F., Sales Engr., The Rail Joint Co., New York, N. Y.
Semple, C. B., Steel Sales Corp., Chicago, Ill.
Shaver, A. G., Cons. Elec. & Sig. Engr., Chicago, Ill.
Sheene, Henry R., Res. Mgr., Union Switch & Signal Co., St. Louis, Mo.
Simmen, P. J., Pres., Simmen Automatic Ry. Sig. Co., Buffalo, N. Y.
Skewes, H. H., Simmons-Boardman Pub. Co., New York.
Snavely, C. S., Engr. Dept., Union Switch & Signal Co., Swissvale, Pa.
Sparks, H. A., Rep., Sig. Dept., Libby Glass Co., Toledo, Ohio.
Sperry, H. M., Pub. Rep., U. S. & S. Co., Gen. Ry. Sig. Co., Fed. Sig. Co., Hall S. & S. Co., New York, N. Y.
Stephenson, James E., Mech. Engr., General Ry. Sig. Co., Rochester, N. Y.
Talbert, W. W., Resident Mgr., Union Switch & Signal Co., Chicago, Ill.
Thomas, L., Res. Mgr., General Railway Signal Co., Chicago, Ill.
Trout. R. E., Thos. A. Edison, Inc.
Tureff, S. J., Office Engr., Federal Signal Co., New York, N. Y.
Underhill, J. Delmar, Salesman, the Okonite Co., New York, N. Y.
Van Steenburgh, W. R., care of the Okenite Co., New York, N. Y.
Vogel, E. W., Pres., Chicago Railway Signal & Supply Co., Chicago, Ill.
Waitt, Walter G., Asst. Factory Mgr., National Carbon Co., Cleveland, O.
Walker, L. S., P. & M. Co., Chicago.
Wallace, H. A., Sig. Engr., Union Switch & Signal Co., Swissvale, Pa.
Whall, F. R., Gen. Mgr., C. H. Whall Co., Boston, Mass.
White, Jas. W., Page Steel & Wire Co.
Wight, S. N., Commercial Engr., General Railway Signal Co., Rochester, N. Y.
Wills, J. R., Sales Engr., General Railway Signal Co., Chicago, Ill.
Wilson, D. O., Thos. Edison, Inc.
Winchell, B. L., Jr., Western Sales Mgr., Kerite Ins. Wire & Cable Co., Chicago, Ill.
Woodbridge, J. L., Chief Engr., Elec. Stor. Bat. Co., Philadelphia, Pa.
Young, J. W., Rep. Kerite Ins. Wire & Cable Co., New York, N. Y.

# Annual Meeting of Appliances Association

## J. B. Strong Elected President; Remarkable Exhibit in Spite of Unusual Difficulties

THE TWELFTH ANNUAL MEETING of the National Railway Appliances Association was held in the Coliseum restaurant yesterday morning at 11 o'clock. In the absence of President P. C. Jacobs, who was detained in the west, the meeting was presided over by Vice-President J. B. Strong.

### President Jacobs' Report

In a report, which was read by Secretary Kelly, President Jacobs stated that all of the exhibit spaces are filled and paid for and "we had at the time of opening 169 members exhibiting and 3 associate members, while we have had many requests and telephone calls for space. We have no one who has paid the membership fee who has not been assigned exhibit space.

"Our exhibition building with annex and restaurant is in a much changed attire, due to the change of color scheme, as well as in the use of the ceiling top in place of our usual flag decoration. The change incurred a very small addition to the expense of former years. There was no change in the floor diagram, but a slight advance in membership and price of floor space was deemed advisable on account of the general trend of the advanced cost of labor and material.

"Registration on Monday was 1,152; attendance Monday, counting from 10:00 a. m. to 6:30 p. m., 2,079, against 3,612 of last year on the same day."

### Vice-President Strong Reports

In supplementing President Jacobs' report Vice-President Strong said in part:

"The space applied for for this exhibit by old members was about 20 per cent more than available. Before allotting space at our directors' meeting on November 24 it was agreed that no member be allotted more space than at last time of exhibiting; also, that preference be given to members who had paid their membership dues. In this way we were able to give space to all members who had paid their membership dues and who had applied for it. There were, however, about 70 applications or inquiries for space from companies who had not paid membership dues and to whom we could offer no space. We could have disposed of considerable additional space if it had been available.

"At our meeting of November 24 the following directors were elected for the balance of our fiscal year: George C. Isbester of the American Chain Company to succeed himself on account of vacancy due to his change of position from the Rail Joint Company; A. A. Taylor of Fairbanks, Morse & Company to succeed A. P. Van Schaick, formerly of the Lackawanna Steel Company, who resigned because of change of position to the American Chain Company.

"The by-laws have been reprinted to include the revision at the March, 1919, meeting, confining voting privileges to acting exhibiting members. Copies of these by-laws may be obtained on application to Secretary Kelly.

"The financial report shows an estimated deficit of about $1,500 for this year's work, leaving a substantial surplus on hand. It is, of course, necessary to carry a surplus over each year to maintain our good standing in prompt payment of expense incurred before receipts commence to come in and also for any emergency that might arise. It is due to the care and judgment of our secretary and treasurer, Mr. Kelly, in carrying out the details that we have been able to show as favorable a report.

"The restaurant facilities have been improved; you can save time and money by patronizing our National Appliances restaurant."

### Report of Secretary-Treasurer Kelly

Secretary-Treasurer Kelly made a brief report as follows:

"During the period in which I have tried to serve you in my present capacity I have never before been called upon to face the difficulties such as we have had during the preparation of this exhibition. The congestion at

the railroad terminal and express offices has been one which is, I think, without a parallel. There was, perhaps, some confusion occasioned from the turning of the railroads back to their owners; this, however, was much aggravated by the storms which we had both east and west of Chicago. The placing of embargoes on express at a time just before the opening of the exhibition did not help the condition much, and while the Coliseum could have been ready for the exhibits on February 3, we were only in possession of less than 50 per cent of the exhibition materials at Saturday noon.

"There has been very little opportunity to prepare, with the information at hand, a financial report. However, the finance committee and treasurer have estimated that we will, with all the uncertainties, be able to make the entire exhibition expense at not to exceed a deficit of $1,500. At the last annual meeting we estimated we were going to have a deficit of about $5,000, when in reality we finally showed a profit of about $400, so we may have some hope of better than we expect this year."

### Other Business

By unanimous vote the actions and transactions of the Board of Directors for the past year were approved.

The suggestion was made that next year a ladies' rest room be arranged for at the Coliseum for the comfort and convenience of visiting ladies as well as for those in attendance at the exhibit booths.

The secretary was empowered to send a telegram to President Jacobs expressing regret at the necessity for his absence from the city at this time.

A vote of appreciation was extended to the retiring officers for their part in making the exhibit a record-breaking success.

### Election of Officers

The report of the nominating committee, composed of **Merle J. Trees, chairman**; J. W. Fogg, E. T. McGarry, Tom R. Wyles and W. B. Murray, recommended the following officers to serve during the coming year, two directors to serve three years, one director to serve two years and one director to serve one year:

President, J. B. Strong, Ramapo Iron Works, Hillburn, N. Y.

Vice-President, George C. Isbester, American Chain Company, Chicago.

Secretary-Treasurer, C. W. Kelly, Kelly-Derby Company, Chicago.

Directors for three years, L. W. Shugg, General Electric Company, Schenectady, N. Y.; A. J. Filkins, Paul Dickinson, Inc., Chicago.

Director for two years, W. J. Gillingham, Hall Switch & Signal Company, New York.

Director for one year, A. A. Taylor, Fairbanks, Morse & Company, Chicago.

The report was adopted by the unanimous election of the men named.

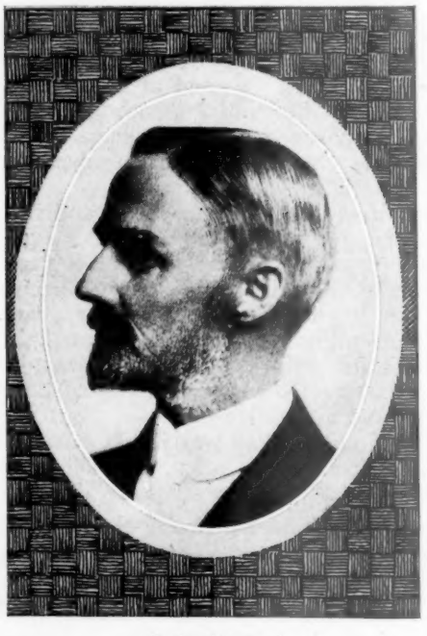
J. B. Strong, who was elected president, is vice-president and general manager of the Ramapo Iron Works, Hillburn, N. Y., and the Canadian Ramapo Iron Works, Limited, Niagara Falls, Ont. He has also recently been appointed consulting engineer of the Manganese Steel Rail Company. In addition to his activity in the National Railway Appliances Association, Mr. Strong has been prominent in the work of the Manganese Track Society since its organization and is at present its chairman. During the war he was chairman of a technical committee of this association, in which capacity he acted as the representative of the manufacturers in advising the director general of military railways on standards for track work. Mr. Strong is also a member of the Track committee of the American Railway Engineering Association and of a sub-committee of that committee which has been engaged for the past two years in the preparation of standards for special track work.

Mr. Strong is a graduate of Sheffield Scientific School, Yale University, class of 1896. After leaving college he entered the employ of Wm. Wharton, Jr., & Company as a draftsman on frog and switch work. Later in the same year he was an assistant engineer on the relocation and construction of the line of the Nova Scotia Southern Railroad from Shelburne, N. S., to Halifax, N. S. In 1897 he returned to engineering work in the states. On January 1, 1901, he became assistant engineer on the Metropolitan Street Railway of New York City, and in 1902 was appointed an assistant engineer in the chief engineer's office of the New York Central, New York City. In 1903 he was made chief engineer of the McPherson Switch & Frog Company, Niagara Falls, N. Y., which concern was consolidated with the Ramapo Iron Works a few months later. Mr. Strong remained at Niagara Falls for two years, during which period he had charge of the construction of a new plant. He was then transferred to the headquarters of this company at Hillburn, where he served for a time as special engineer on estimates and designs of frog and switch equipment. He was later made assistant general manager and chief engineer, and then vice-president and general manager, his present position. As his record in the Appliances Association shows, Mr. Strong is an indefatigable worker, with the faculty of enlisting the loyalty and co-operation of his associates.

## J. A. Atwood Passes Away

FOR THE FIRST TIME IN a number of years the American Railway Engineering Association has lost one of its active officers by death, J. A. Atwood, second vice-president, having passed away on February 29, following an attack of influenza.

Mr. Atwood was a charter member of the association.



J. A. Atwood

Although of a retiring disposition and seldom taking part in the discussion on the floor of the convention, he was active in the work of the organization and had its interest much at heart. He was chairman of the Rail Committee in 1913, 1914 and 1915, and had also been chairman

of the Yards and Terminals Committee a number of years ago. Mr. Atwood was elected a member of the Board of Direction at the 1917 convention, and was elected second vice-president a year ago. Under the rules of the association he would have moved up to first vice-president automotically at this convention and would have been the logical candidate for president next year. It will now be the duty of the Board of Direction to select his successor from among its members.

Mr. Atwood was born at Chatham, Mass., on February 8, 1857, and graduated from New York University in 1878. He entered railway service the same year as a transitman on the New York Elevated Railroad. After being engaged in engineering work on a number of roads for nine years, he first became connected with the New York Central System in 1887, when he was appointed an assistant engineer on the Lake Shore & Michigan Southern. Two years later he was transferred to the Pittsburgh & Lake Erie as engineer of construction and in 1896 was appointed chief engineer, which position he held at the time of his death.

At the time Mr. Atwood became connected with the Pittsburgh & Lake Erie it was contemplating an extensive improvement program, including the construction of second, third and fourth tracks and the rebuilding of its terminals and other facilities to enable it to handle the large and rapidly increasing traffic offered to it. It was Mr. Atwood's problem to carry on this construction work in the face of serious engineering and operating difficulties. That he was successful is indicated by his promotion to the position of chief engineer. In this latter position Mr. Atwood exerted an important influence on the development of high grade standards of maintenance, for it has been under his direction that the Pittsburgh & Lake Erie has been and is today pioneering in a number of developments among which are a special tie plate construction and the development of experimental ties.

Mr. Atwood was buried at his home in Beaver, Pa., on March 3. A. R. Raymer, assistant chief engineer of the Pittsburgh & Lake Erie, and other members of the association represented it at that service. A committee, consisting of A. R. Raymer, R. A. Pearce and W. C. Cushing, has been appointed from the association to prepare suitable resolutions for presentation at this convention.

## Purdue Alumni Meeting

The Chicago Alumni Association of Purdue University will hold a special luncheon at the University Club, 76 East Monroe street (northeast corner of Michigan boulevard and Monroe street), at 12:30, Wednesday noon, to which all Purdue men in attendance at the engineering and signal conventions are invited. It is expected that several members of the university faculty will be present. The alumni have taken a special interest in this luncheon in view of the fact that the A. R. E. A. president-elect, H. R. Safford, and the vice-president-elect, L. A. Downs, are both alumni of that institution.

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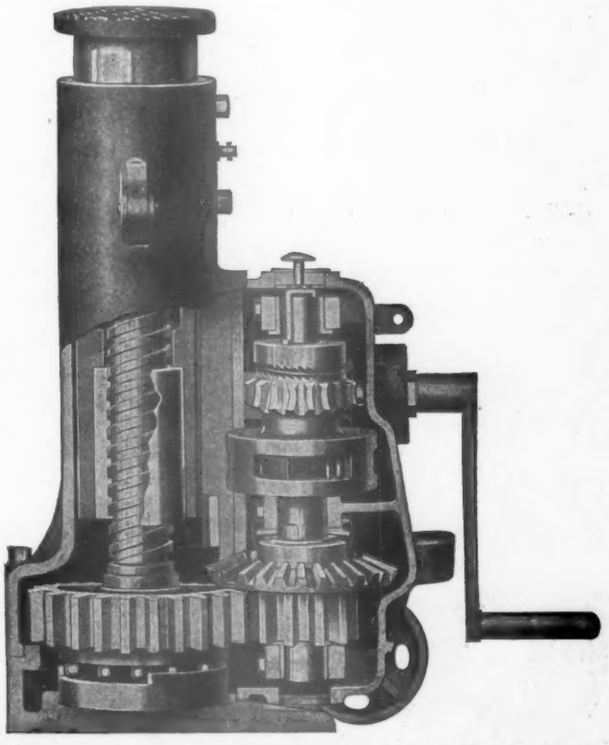
# A High Speed Ball-Bearing Screw Jack

A HIGH-SPEED, BALL-BEARING screw jack of 75 tons rated capacity has recently been placed on the market by the Duff Manufacturing Company, Pittsburgh, Pa., which is especially adapted for use in lifting bridges, for which service ball-bearing screw jacks are coming into considerable use because of their lower maintenance cost and the fact that they can be operated by unskilled labor.

The feature which distinguishes this jack from other high-speed screw jacks is the location of the operating mechanism in the base instead of in the head. The greater weight is thus placed at the bottom instead of at the top. This offers the advantages that the jack is not top-heavy and that the point at which the operating lever is pivoted does not rise with the load. The power of the stroke is thus unaffected by the changing position of the operating lever as the load is raised. The concentration of the weight in the base of the jack also facilitates moving it about. The base is fitted with a pair of small wheels of sturdy design on which it may be propelled by inserting the operating lever in a socket especially provided for that purpose and tipping it over to an angle at which it may conveniently be pushed about by means of the operating lever.

The steel operating lever is six feet long and operates the jack through a ratchet socket and gearing. The



**Construction of the Duff High-Speed, Ball-Bearing Jack**

screw has a double tread of exceptionally deep pitch, making the action very rapid for a jack of this capacity, and the load is carried on a ball thrust bearing below the main gear in the base. The screw is made of special machinery steel, heat treated, and turns in a bronze nut of special composition, a combination which materially reduces friction. For lowering, a crank handle operating through a worm gear is used. The action is rapid and only a few turns are required to release the jack.

Safety is assured by a positive clutch which holds the load at all times, keeping it from sinking or lowering. The fact that the holding clutch does not permit any appreciable sink-back assures a maximum lift for all of the pressure applied to the elevating lever. In lowering, the load may be stopped with absolute safety at any point desired regardless of the speed at which it may be descending. The action is said to be positive, so that there is no possibility of sticking. Another safety measure which has been incorporated in the design of this jack is a signal provided to indicate when the jack has reached its maximum height.

This jack has been tested under severe operating conditions and its service has demonstrated that the rating

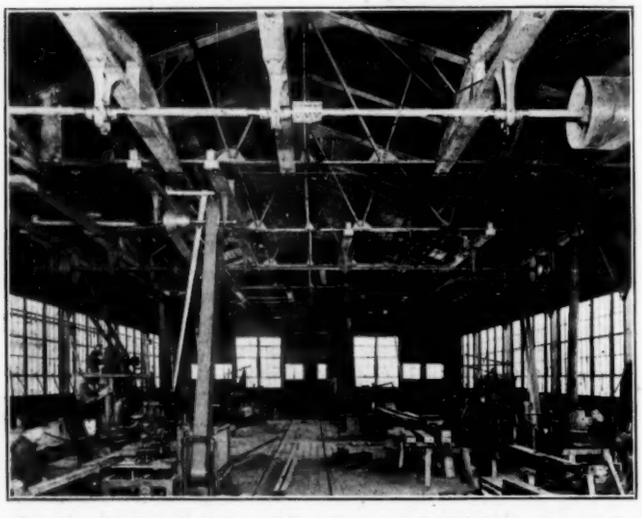
of 75 tons is conservative. Among the tests to which it has been subjected was the raising of the rear end of a locomotive, weighing 215 tons, so that the rear wheels were off the track. In this test it was estimated that the jack supported a weight of over 95 tons.

The jack is built in three sizes, with heights of 20 in., 24 in. and 26 in., respectively. The 20-in. jack has a maximum lift of 6 in., the 24-in. jack 10 in. and the 26-in. jack 12 in.

## A Large Size Portable Steel Building

AMONG THE VARIOUS BUILDINGS constructed during the fall of 1919 by the Atchison, Topeka & Santa Fe was a planing mill for the Chicago car shops which is of special interest because of its portability and adaptability for a wide variety of purposes. The new structure is a Truscon standard steel building of unit construction with a clear span 50 ft. wide and 126 ft. long, to which has been added a lean-to 16 ft wide and 66 ft. long. The material was shipped complete from the Truscon Steel Company, Youngstown, Ohio, in five carloads and was erected by the railroad in a little over 14 days.

The foundations for the new building were of concrete with a total height of three feet. Standard framing was used throughout with the exception of the roof trusses, which were of a heavier pattern than those generally furnished because of the increased strength made necessary by the installation of a large amount of line shafting. The main roof supports or columns were spaced 16 ft. apart and the main roof trusses were fastened directly to them, the intermediate steel rafters being supported by light steel beams running longitudinally between the main trusses. The outside walls were assembled from the standard 4-ft. by 11-ft. 6-in. panels made of 18-gage steel, each panel with the exception of the door panels and a few solid panels being equipped with window sash, three



**Interior View, Showing Clear Span and Lighting Arrangements**

lights wide and five lights deep of 14-in. by 20-in. glass. The third and fourth rows from the top of each panel were arranged as a mechanically-operated section for the purpose of ventilation. These four-foot panel sections are held by light specially-formed steel uprights spaced on four-foot centers, each upright or mullion, as it is called, having a square ridge on both sides running the entire length of the piece with a series of rectangular holes on each side of the ridges. The edges of the metal panels are turned back at right angles, pressed to a shape to correspond with the mullion and punched with holes at the proper distances apart to align with those in the upright. They are then locked in position by inserting a T-shaped slotted bolt through the two panels with the mullion in between, after which a wedge is driven into the slot of the bolt, thus drawing the section tightly together. This method eliminates the possible beating-in of rain, etc., for it provides four right-angles which must be passed before that could occur.

The roofing consists of long, narrow steel plates which are made in an interlocking form by folding over the edges, the lower edge or edge nearest the eaves being

**Exterior View, Showing Panel Construction**

turned back in such a way as to form a "step" in the roofing at each joint between the ridge and the eaves. In assembling the roof the long edges of each section are engaged with the turned edges of the adjacent section to form an interlocked joint which is held firmly together by special clips. These are driven over the joints and at the same time over the rafters or trusses, thus making the roof trusses and rafters a well tied together unit. The joints between the end of the roof plates are connected and at the same time made water-tight by the use of special clips which are driven on, interlocking with the turned over edges of the roof and extending over and under the step.

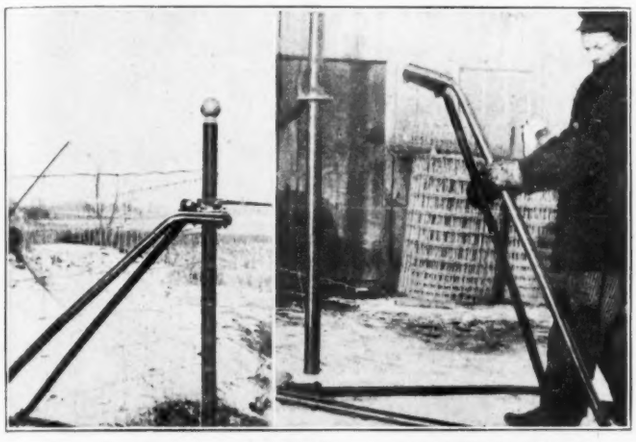
Other parts of the building, including doors of various types, etc., are assembled in a similar manner by the use of bolts, combination of slotted bolts and wedges, and by special clips. All joints are made water-tight by making it necessary for the water to pass at least three right angles before it can reach the interior of the building. The entire assembly is such that the building can be enlarged at any time or dismantled and reassembled at another location with no loss due to damage or salvage of the structural parts.

## A Fence-Tightening End and Corner Post

A FENCE POST CONSTRUCTED either of concrete or iron and recently introduced by the Daisy Fence & Post Co., Dayton, Ohio, contains a fence-tightening feature which permits a right-of-way fence to be kept in good condition for an indefinite period. The iron post consists primarily of a large size metal pipe standard supported by a triangular metal plate, to which are securely fastened the ends of a bar of metal formed in the shape of a triangle. The triangular bar represents the supporting base of the entire post and has two heavy circular reinforcing rods running from its remaining two corners up to a ratchet and bearing mounted at a height of about two-thirds the length of the post. The fence wire is attached to the post by slipping their ends through small holes drilled in the upright or pipe standard, and fastened by

bending the ends back around the post and looping them over the fencing itself. The fence can then be tightened by means of the ratchet and a special open-end wrench, a few turns making it as tight as desired. In case the fence stretches and sags in a year or two the slack can be taken up by applying the wrench and turning the ratchet until the fence is brought to the required tension.

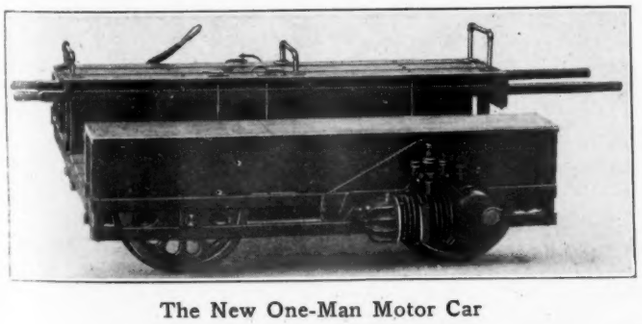
The concrete fence-tightening post is similar in principle, the construction differing only in that a heavy concrete post is used as the backing or brace for the revolving standard to which the wires are attached. These posts are designed to stretch and tighten from 80 to 100 rods of fence and are customarily installed about 80 rods apart on line fences with ordinary wood, concrete or iron intermediate posts spaced 20 ft. apart. Where they are used in this manner the fence wire straddles the base, which has a maximum width of 28½ in.



**The Method of Assembling and the Post Installed**

## A New Motor Car for One-Man Operation

ONE OF THE NEW MOTOR CARS manufactured by Mudge & Company, Chicago, is a side-mounted car which differs from other models in that the motor is mounted on the right front wheel. The engine consists of a two-cylinder, two-cycle motor of eight horsepower and weighs 590 lb. This power plant is direct connected to the wheel, the crank shaft of the motor acting also as the axle of the wheel. This arrangement dispenses with all driving gears or separate driving axles and permits the use of independent or free running wheels throughout. The tool boxes, which also serve as wheel guards, have been mounted on each side of the car and run the full length of it. The rear end, that is, the end opposite the motor, is the lift end of the car and, because of this feature, one man can handle it easily where it is required to lift the car on or off the track at road crossings, etc.



**The New One-Man Motor Car**

## A New Gas for Cutting Metals

CUTTING STEEL BY RAPID oxidation has become so important a factor in the repair and manufacture of metal parts that any improvement in the process is certain to be of interest. The first torches for the cutting of metals depended on the use of oxygen and hydrogen, a mixed stream of the two gases at low pressure producing a flame which was used to heat to a bright red a small part of the surface of the metal to be cut. Then a high pressure jet of oxygen from the same torch was snapped on and allowed to project itself through the preheating flame so as to strike against the hot metal and cutting it by instantaneous oxidation or burning. The successful commercial manufacture of calcium carbide soon made acetylene an active competitor of hydrogen for cutting metals. This condition brought about a careful study of the merits of an ignition gas for metal cutting, and, as a result, many special cutting gases have entered the field.

A common fallacy is that the efficiency of a cutting gas depends entirely on its thermal contents in B.t.u. This is not the case, as may be shown by a simple comparison of Blau gas and acetylene, for the former has a heat value of 1800 B.t.u. per cu. ft. and the latter 1400 B.t.u. Yet the highest temperature obtainable from Blau gas is about 5000 deg. F. as compared with 6300 deg. F. for acetylene. The high temperature of the acetylene flame is partly due to its endothermic property, but chiefly to the characteristic action of the gas in releasing its heat units at a rate faster than the absorption by and the conduction of the heat through the metal being cut, as well as the ability of the flame to maintain its initial temperature. Carbon is the chemical element in a gas which probably will produce the most rapid rate of combustion, provided it is not retarded by some other element.

Calorene, a new cutting gas manufactured by the Air Reduction Sales Company, New York City, possesses some interesting characteristics which were described in a paper presented by Professor Alfred S. Kinsey of Stevens Institute of Technology, Hoboken, N. J., before the American Foundrymen's Association at Philadelpia, Pa., on September 29 to October 3, 1919. Calorene is an unsaturated gas, an analysis showing it to contain 86 per cent carbon and 14 per cent hydrogen, with a heat value of 1580 B.t.u. per cu. ft. The following data obtained in tests recently made by Professor Kinsey shows the comparative cutting qualities of the new gas in thin and thick metal:

TO CUT BY HAND TORCH 100 SQ. IN. OF STEEL WITH CALORENE

| | | | Consumption | | | Cost | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Thickness | Time | Oxygen | Calorene | Labor | Oxygen | Calorene | | Lineal ft. cut |
| Material | inches | min. | cu. ft. | cu. ft. | 68c | $1.25 | $2.00 | Total | per hr. |
| Steel plate | 0.41 | 12.04 | 10.66 | 4.73 | $0.14 | $0.13 | $0.10 | $0.37 | 101.5 |
| Steel forging | 2.25 | 6.93 | 22.60 | 2.04 | .08 | .28 | .04 | .40 | 32.0 |
| Steel casting | 9.00 | 3.5 | 24.55 | 1.66 | .04 | .31 | .03 | .38 | 16.0 |

It will be seen that while the consumption of oxygen per cu. ft. increases with the thickness of the metal being cut, both the labor and consumption of calorene decrease, resulting in a low figure for the total cost per sq. in. of metal cut.

Another feature of calorene is its portability, for a full cylinder of calorene containing 210 cu. ft. weighs only 85 lb., as compared with 145 lb. for another well known cutting gas which is called "Gas No. 3" in Table 2, and 206 lb. for acetylene. The following table gives the figures showing the total weight of the cylinders and gas re-

quired to be handled to cut one million lineal feet of ⅜-in. boiler plate.

| Kind of gas | Cylinder Pressure lb. sq. in. | Capacity cu. ft. | Gross weight lb. | Total weight in lb. | Relative weight to be carried |
|---|---|---|---|---|---|
| Calorene | 1,250 | 210 | 85 | 9,000 | 1.0 |
| Acetylene | 250 | 275 | 206 | 29,000 | 3.2 |
| Gas No. 3 | 1,800 | 200 | 145 | 69,000 | 7.7 |

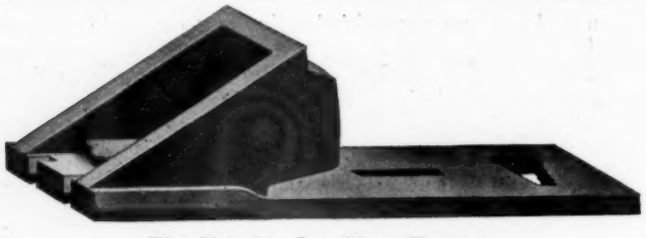
The kerf scale produced by calorene in cutting is about 0.008 in. thick on a 4-in. cut and is always noticeably thin and fragile, the under surface being undisturbed in relative hardness as determined by the scleroscope and file. The explosibility of the new gas is of interest for its explosive range is from about 4 of calorene and 96 of air to 14 of calorene and 86 of air, as compared with a range of 3 of acetylene and 97 of air to 70 of acetylene and 30 of air. It may be brought in contact with oil and grease without danger. Calorene may be compressed safely to a pressure of 3500 lb. per sq. in. and stored as a free gas, no filler being required in the cylinders, which partly accounts for the lightness of a commercial cylinder. It will work freely at zero temperature, and its point of combustion is about that of illuminating gas. It has a pleasant odor, and its products of combustion are unnoticeable and harmless. The valuable cone of the oxy-acetylene flame is as plainly outlined in the oxy-calorene flame.

## A Tie Plate Fastener for Guard Rails

THE VAUGHN TIE PLATE guard rail fastener recently introduced by the M. W. Supply Company, Philadelphia, Pa., is a one-piece fastener to be used in tracks carrying heavy traffic. The device consists of a heavy plate having a strong casting with two shoulders extending back to the end, the entire raised portion being so formed as to make a substantial rail brace.

In the manufacture of this device a ⅝-in. rolled steel plate measuring 7 in. wide by 18⅞ in. long is punched and formed by presses so as to have a slight step or raise of ⅜ in. about 5 or 6 in. from one end. At the same time six holes approximately 1½ in. in diameter and three spike holes or slots are punched through the raised ends, while about midway of the plate there is formed a long slot running longitudinally, the end opposite the raised portion having a large adjustable slot opening in steps.

After this preliminary work of forming the plate, it is placed in a mold and the brace cast on it, the hot metal



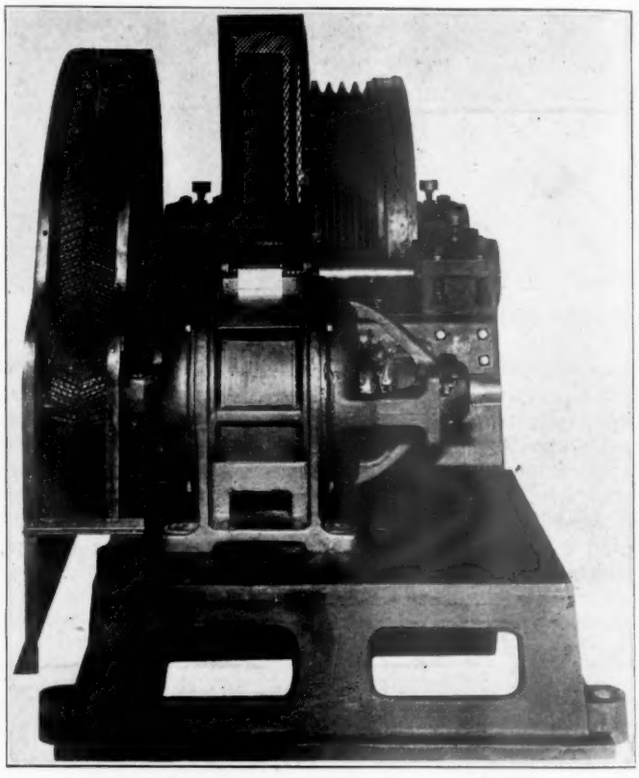
**The Vaughn One-Piece Fastener**

running through the 1½-in. holes and forming a plate under the raised portion and the brace proper on the upper side. This manner of forming a casting, not only on but through and under the rolled steel plate, makes a one-piece fastener of strength and rigidity. The face in contact with the rail is shaped in the casting for the rail section with which it is to be used.

In applying the fastener to the track it is only necessary to slide the plate under the guard rail and the main rail until the desired throat is obtained. The plate can then be spiked down, the locking spike being placed in the proper step of the large opening at the end opposite the brace.

## The New Ross Traction Hoist

A NEW HOIST recently developed by the Roberts & Schaefer Company, Chicago, for use in coaling plants contains several new features which are of general interest. In the Ross hoist, a heavy duty motor is mounted on one end of a cast iron base and is connected to the hoisting countershaft by means of a Falk herringbone pinion and gear and from the countershaft to the cable drum by a straight cut pinion and gear. This manner of construction forms a self-contained unit which can be lined up in advance at the shop and shipped on skids, thus obviat-



**The Complete Unit Ready for Installation**

ing the necessity for lining up the hoist when making the final installation. All gears are enclosed by wire guards which extend over both the sides and the tops of each gear unit and in the case of the outside gear, the guard extends downward to within a few inches of the bottom of the cast iron base.

One of the main features of the hoist is the installation or arrangement of the cable drum rim in segments which can be removed, a segment at a time when they become worn and require replacing, without dismantling the coaling plant or loosening the hoisting cable. The traction principle employed is that of the "deep V groove," which, it is claimed, will prevent any overwinding of the elevating bucket. Should the balancing counterweight or the balanced bucket overwind slightly, the corresponding bucket or counterweight will strike the bumper in the bottom of the pit and cause a slack in the cable, thus preventing a continuance of the traction effort and consequently avoiding the wrecking of the elevator equipment.

This type of hoist will be part of the equipment of the coaling plants now being built by the Roberts & Schaefer Company for the Pere Marquette at Plymouth, Mich., and also for the Union Railroad of Pittsburgh at Clairton, Pa.